THE JOURNAL

OF

TROPICAL GEOGRAPHY

VOLUME TWELVE

MARCH 1959

RURAL DEVELOPMENT IN TROPICAL AREAS, with special reference to Malaya

By

OOI Jin-bee, M.A., D.PHIL.

Printed with a grant from the
University of Malaya

PUBLISHED BY THE DEPARTMENTS OF GEOGRAPHY
UNIVERSITY OF MALAYA IN SINGAPORE AND
UNIVERSITY OF MALAYA IN KUALA LUMPUR

The maps and diagrams in this volume
were drawn by Messrs. J. Ngai and
Poon Puay-kee

This volume
is an abridgment of a thesis
presented for the degree of Doctor of Philosophy
in the University of Oxford,
November 1956

ACKNOWLEDGEMENTS

I am deeply indebted to Dr. E.H.G. Dobby, formerly Professor of Geography, University of Malaya, for putting forward the idea of research in the field of rural development, and for the many ways in which he has encouraged me in this study. I am particularly grateful to my supervisor, Mr. R.W. Steel, Fellow of Jesus College, Oxford (now Professor of Geography, University of Liverpool), for his patience, helpful criticism, guidance and encouragement at all times. My period of research work at Oxford was made possible through the kindness of the Warden of St. Antony's College, Mr. F.W.D. Deakin. I would also like to take this opportunity of thanking the Librarian, Colonial Office Library, London, for allowing me access to otherwise unobtainable material.

I am indebted to the University of Malaya for having generously provided a grant towards the cost of publication. Mr. W.L. Dale and Dr. P. Wheatley have been most helpful editors. The original manuscript has been read by Mr. E. Paget, School of Geography, Oxford; Mr. C.A. Fisher, Department of Geography, University of Leicester; and Ungku Aziz, Department of Economics, University of Malaya. I am grateful for their valuable suggestions and criticism.

The present text is an abridged version of a thesis entitled 'Geographical Problems of Rural Development in Tropical Areas, with special reference to Malaya', approved for the degree of Doctor of Philosophy, University of Oxford, in November, 1956. While every effort has been made to keep up with the changes that have taken place in the Federation of Malaya since 1956, especially with regard to statistical data, it is impossible to be completely up to date, particularly in matters of detail. For any errors and omissions that may remain I am, of course, solely responsible.

Ooi Jin-bee

University of Malaya
Singapore.
March, 1959

CONTENTS

MAPS AND DIAGRAMS

TABLES

ABBREVIATIONS

A.A.A.G.—Annals of the Association of American Geographers.
C.D. & W.—Colonial Development and Welfare.
D.I.D.—Drainage and Irrigation Department (of Malaya).
E.C.A.F.E.—Economic Commission for Asia and the Far East.
F.A.O.—Food and Agricultural Organization.
Fed. Leg. Co. — Federal Legislative Council.
F.M.S.—Federated Malay States.
I.M.R.—Institute for Medical Research (Malaya).
I.P.R.—Institute of Pacific Relations.
I.L.O.—International Labour Organization
Jrn. of Afr. Admin.—Journal of African Administration.
J.M.B.R.A.S.—Journal of the Malayan Branch of the Royal Asiatic Society.
J.S.B.R.A.S.—Journal of the Straits Branch of the Royal Asiatic Society.
Jrn. Roy. Afr. Soc.—Journal of the Royal African Society.
J.R.A.S.—Journal of the Royal Asiatic Society.
Jrn. Roy. Central Asian Soc.—Journal of the Royal Central Asian Society.
M.A.J.—Malayan Agricultural Journal.
M.J.T.G.—Malayan Journal of Tropical Geography.
Malayan Med. Jrn.—Malayan Medical Journal.
Mem. Roy. Met. Soc.—Memoirs of the Royal Meteorological Society.
P.W.D.—Public Works Department.
Qrtly. Jrn. Roy. Met. Soc.—Quarterly Journal of the Royal Meteorological Society.
R.R.I.—Rubber Research Institute (Malaya).
R.I.D.A.—Rural and Industrial Development Authority (of Malaya).
S.—Sungei.
S.S.—Straits Settlements.
Trans. Roy. Soc. Trop. Med. & Hyg.—Transactions of the Royal Society of Tropical Medicine and Hygiene.
Trop. Agriculture—Tropical Agriculture (Trinidad).
U.F.M.S.—Unfederated Malay States.
U.N.—United Nations.
U.N.E.S.C.O.—United Nations Educational, Scientific and Cultural Organization.

GLOSSARY OF MALAY TERMS

alor—elongated depression between sandy ridges.
atap—roofing thatch made from the leaves of the Nipah Palm.
barah—low-lying land, often an old lagoon.
bĕlukar—secondary forest; scrub.
bĕndang—flooded padi-field (Kedah).
gantang—Imperial gallon (1 gantang of padi weighs approximately 5.5 lb.).
gĕlam—a swamp tree *Melaleuca leucadendron.*
kampong—used here in two senses: (1) a Malay village or settlement; and (2) a mixed garden composed of a heterogeneous collection of tree and bush crops.
kuncha—160 gantangs.
ladang—shifting cultivation.
lalang—a coarse grass *Imperata cylindrica.*
mukim—subdivision of an administrative district.
nipah—brackish-water palm *Nipa fruticans.*
padi—the growing plant and unhusked grains of *Oryza sativa.*
padi kuncha or padi ratus—system of agricultural credit whereby a padi-planter obtains credit by selling his crop forward, usually to a rice-dealer or shopkeeper, and for a fraction of its value.
pĕrmatang—bank, rising ground.
ra'yat—peasant.
sawah—flooded padi-field (South Malaya).
sumatras—local line-squalls, common in the Straits of Malacca.
sungei—river.

INTRODUCTION

IN ORDER to clarify and delimit the scope and extent of this study, it will be necessary to define the terms 'tropical' and 'development.' The word 'tropical' when defined on the basis of mathematical-astronomical criteria refers only to those areas of the world between the Tropics of Cancer and Capricorn. However, convenient though the Tropics of Cancer and Capricorn are for some purposes, geographers are agreed that they are not of great value as boundaries because they cut across regions of uniform character. Yet, while almost unanimous in rejecting the mathematical-astronomical definition of 'tropical', they have come to no general agreement upon an alternative definition, though several suggestions have been made. The most popular method of demarcation is by means of the annual isotherms. Supan, in 1896, put forward the suggestion that the mean annual isotherm of 20°C (68°F) should mark the poleward limits of the tropics. The area contained between the mean annual isotherms of 20°C for the two hemispheres more or less coincides with the trade wind belt, and the area of palm tree growth. Miller has suggested that the isotherm of 64°F for the coldest month should be the limit of the hot climates, 'the test of which is that all months are "hot" and there is no relief in a "warm" or "cold" season.'[1] On this criterion of temperature alone the tropical areas of the world as demarcated by Miller include most of the land contained between the Tropics of Cancer and Capricorn, except the highlands of Mexico and the Andes Cordillera, parts of the Rift Highlands and Plateaux of Africa, the deserts of Central Australia and the Kalahari in Africa.

It is apparent that a definition on the basis of temperature alone would inevitably include within the tropical zone large areas with low rainfall and low humidity. Also within the boundaries of the 64°F isotherm for the coldest month, or the 68°F mean annual isotherm, there are several different types of 'tropics', such as the equatorial tropics; trade wind coasts and islands; 'wet-dry' and monsoonal areas; deserts; mountains; plateaux and the marginal zones. Apart from the temperature, the rainfall and humidity in each of these areas may vary greatly and create local climates.

Since the main part of this study involves the examination of peasant primary production, and especially of peasant agricultural production, it would be more pertinent to adopt a definition which includes both temperature and rainfall as criteria, but which at the same time is flexible enough to allow of departure from the defined conditions. Gourou's definition would seem to fit the circumstances. He defines tropical areas as 'lands which have a mean monthly temperature of at least 65°F and get enough rain for agriculture to be possible without irrigation.'[2] These areas include most of South America north of the Tropic of Capricorn except N.E. Brazil and the Andes Cordillera, the West Indian islands, and Central America with a coastal extension beyond the Tropic of Cancer along the Gulf of Mexico and the southern tip of Florida. In Africa the tropical lands are bounded on the north by a line running north-west to south-east from Cape Verde to the coast of Kenya, and on the south by a line from Boma on the west coast to Courenco on the east coast. The Equator roughly bisects the area contained between these two boundaries, except in the East African highlands, where climatic conditions are markedly different from those of the rest of the area. The Eastern

1. A.A. Miller, 'Three New Climatic Maps', *Institute of British Geographers, Transactions and Papers, 1951* (London, 1952), map No. 2, facing p.17, and p.19.
2. P. Gourou, *The Tropical World* (London, 1954), p.1.

tropics include the Indian sub-continent south of the Himalayas, all the monsoon lands of the Indo-Chinese peninsula, the Malay Peninsula, the Malay Archipelago, the Philippines and New Guinea. In Australia, tropical conditions are found in a narrow coastal strip from Darwin in Northern Territory to Hervey Bay in Queensland.

'Development' means change or an advancement, gradual or rapid, from one state of affairs to another and better state.[1] But as there are many shades of meaning attached to the word, 'development' here will need to have a qualifying adjective before it. It is economic development, or more precisely, one aspect of economic development, that is the theme of study, namely the raising of the material living conditions of the rural population. Ordinarily this means a consideration of the standards of living, with money income as the criterion by which comparisons are made. However, there are several difficulties involved in using money income as a criterion. A basic difficulty common to many so-called underdeveloped countries is the tenuous and sometimes complete lack of relation between increase of money income and improvement in standards of living. Very often, a quantitative increase in real income is not accompanied by a subjective demand for a different and higher standard of living.

The standard of living itself is an elusive concept, and has different connotations among different peoples with varying cultures, and even among individuals within the same cultural environment. The complexity of the problem arises from the inclusion of many non measurable and subjective criteria and values within the concept of a standard of living, such as, social security, human freedoms, recreation, entertainment, and other terms connected with human emotion and states of mind. One method of overcoming this problem is to include only those components of the standard of living that are capable of statistical treatment, as for example, the basic needs for food, clothing and shelter, or some such criteria both measurable and material, and therefore comparable. Hence for the purpose of this study 'development' is taken to mean the advancement of *material* living conditions, using such indicators as admit of measurement.[2]

Problems of rural development are problems connected mainly with the development of fishing and agriculture, which are the main occupations of most of the peoples living in tropical countries, as Table 1 indicates. Of the total world population of 2,176 million in 1948, some 60 per cent, or almost 1,300 million people, were dependent upon agriculture. Of these only 162 million were in Europe and North America, compared with 1,100 million in Asia, Africa, Central and South America, within which are the world's major tropical areas. An indicator of the variation in living standards within this major section of the world's population is the productivity per person in agriculture. Whereas in North America the annual average output per person is 2.5 tons, the corresponding output in Asia is less than 0.25 ton, and in Africa, a continent with two-thirds of its area within the tropics, less than 0.125 ton.[3]

1. Or as Frankel has put it '... to speak of development, or lack of it, is to assume that the society to which the term is applied is proceeding, or is failing to proceed, in a certain direction—towards a preconceived foreseeable goal or end, the attainment or partial attainment of which will indicate a more desirable state of affairs than that now being experienced, or than that which the society experienced in the past.' S.H. Frankel, 'Some Conceptual Aspects of International Economic Development of Underdeveloped Territories', *Essays in International Finance, No. 14* (Princeton, New Jersey, 1952), p.1.
2. U.N.E.S.C.O. *Report on International Definition and Measurement of Standards and Levels of Living* (New York, 1954), pp.79-80.
3. U.N., *Land Reform: Defects in Agrarian Structure as Obstacles to Economic Development* (New York, 1951), p.4.

TABLE 1: PROPORTION OF WORLD POPULATION ENGAGED IN AGRICULTURE, 1949

TERRITORY	TOTAL POPULATION (MILLIONS)	AGRICULTURAL POPULATION (MILLIONS)	AGRICULTURAL POPULATION AS A PERCENTAGE OF TOTAL
NORTH AMERICA (U.S.A. AND CANADA)	163	33	20
EUROPE	391	129	33
OCEANIA	12	4	33
SOUTH AMERICA	107	64	60
CENTRAL AMERICA (INCL. MEXICO)	50	33	67
ASIA	1,255	878	70
AFRICA	198	146	74
TOTAL	2,176	1,287	59

Source: F.A.O., *Yearbook of Food and Agriculture, 1950* (New York, 1950), p.15.

This study, therefore, is concerned with the peasant smallholders who constitute the bulk of the population in tropical areas, and whose standards of living are among the lowest of the different classes within the tropical economic framework.

Whatever course should be followed in order to raise these living standards depends upon a complexity of factors. A separate appraisal of the situation is necessary for each political territory, and for each region within such a territory, for the problems that exist in any one region are uniquely determined by the interplay of natural forces, man, and his institutions, attitudes, technologies and aims. Nevertheless, this does not totally invalidate generalizations regarding the nature of those problems, for often the situations that give rise to them in one region are met again, perhaps in a different form or under a different guise, in another region. The method followed in this study involves the analysis and examination of the specific problems of a particular tropical region, namely Malaya,[1] and a brief discussion of similar or contrasting problems in other parts of the tropics.

1. Though basically similar in its physical characteristics to the Federation of Malaya, the Colony of Singapore is economically, socially and politically distinct from it. The present study is concerned specifically with the Federation of Malaya, and does not include Singapore. The Federation to-day is made up of two Settlements (Penang—Province Wellesley, and Malacca) and nine Malay States (Fig. 1 inset).

CHAPTER I

THE PRIMARY RURAL POPULATION

IN A RECENT work, Stamp recognizes three groups of people in the rural category:— (1) the 'primary rural population' which includes farmers and farm workers and their dependents, living directly from the land; (2) the 'secondary rural population' which provides services for the primary group, and which is essential for the maintenance of the rural structure; and (3) the 'adventitious people' who live in rural areas by choice rather than by necessity.[1] In a tropical colonial economy, as exemplified by Malaya, the 'primary rural population' includes not only farmers but also other sections of the population engaged in primary production, such as peasant fishermen. This study is not directly concerned with large commercial agricultural undertakings controlled and worked by the non-indigenous population, hence plantations producing agricultural crops for export will be considered only in so far as their activities impinge upon and influence the economies of the peasant producers. It is concerned, however, with that section of the population in commercialized production within the indigenous agricultural economies,[2] as, for example, the rubber smallholders. The 'secondary rural population' in Malaya is composed largely of the immigrant peoples who control the economic links between the primary producers and their markets. The third group of people in the rural category as described by Stamp is of little importance in the tropical colonial context, and will be omitted from consideration.

The emphasis is, therefore, on small scale peasant production, and the focus of attention is the *peasant,* defined by Firth as '... a countryman—a man engaged in rural pursuits, primarily agriculture, with a comparatively simple technology and a special interest in the land he works. In South-east Asia, one may extend the application of the term to cover the majority of fishermen and even village craftsmen too. They are of the same social class as the agriculturists, and often members of the same families. As occupational groups, they may even be separable only in theory, since many a peasant farmer is also a fisherman or craftsman by turns as his seasonal cycle or cash needs influence him.'[3] Non-specialization of economic activities is the hall-mark not only of the South-east Asian peasant structure, but also of many economies still in the subsistence stage, as in tropical Africa. In Malaya a similar situation prevails, production being to a large extent for subsistence, but also in an increasing number of instances solely for cash, and still more frequently, for a combination of both.

The importance of peasant agricultural economies in tropical areas is illustrated by the proportion of the total population engaged in them. Table 2 shows the position in nine main countries in tropical Africa. For the nine territories as a whole, the number of adult males engaged within the indigenous agricultural economies is 87 per cent of the total male population, and, of

1. L.D. Stamp, *Our Undeveloped World* (London, 1953), p. 71.
2. 'The indigenous agricultural economy comprises resources of land and labour employed both in subsistence production and in production for sale... Wage-earners and others permanently divorced from the indigenous agricultural economy are not here considered part of it'. U.N., *Enlargement of the Exchange Economy in Tropical Africa* (New York, 1954), p.2.
3. R. Firth, 'The Peasantry of South-east Asia,' *International Affairs,* Vol. XXVI, No. 4, 1950, p. 503.

this, 60 per cent are engaged in subsistence production. Very little of what is produced leaves the farm, and the pattern of production is basically a self-sufficient one. Commercialized production within the peasant economic framework accounts for the remaining 27 per cent. This does not mean that there is a sharp division between the section of the population engaged in subsistence agriculture

TABLE 2: NUMBER OF ADULT[1] MALE AFRICANS EMPLOYED WITHIN THE INDIGENOUS AGRICULTURAL ECONOMIES,[2] EXPRESSED AS A PERCENTAGE OF THE TOTAL ADULT MALE POPULATION, 1950

TERRITORY	TOTAL ADULT MALE POPULATION (IN THOUSANDS)	PERCENTAGE OF TOTAL MALE POPULATION IN PEASANT PRODUCTION		TOTAL OF (3) AND (4)	PERCENTAGE IN OUTSIDE WAGE-EARNING
		IN SUBSISTENCE PRODUCTION	IN COMMERCIALIZED PRODUCTION WITHIN INDIGENOUS AGRICULTURAL ECONOMIES		
(1)	(2)	(3)	(4)	(5)	(6)
BELGIAN CONGO	3,241	41	29	70	30
FRENCH EQUATORIAL AFRICA	1,253	62	23	85	15
FRENCH WEST AFRICA	4,898	77	18	95	5
GOLD COAST	1,219	21	64	85	15
NIGERIA	6,943	57	39	96	4
SOUTHERN RHODESIA	493	51	9	60	40
TANGANYIKA	2,100	63	18	81	19
UGANDA	1,405	59	29	88	12
KENYA	1,500	70	5	75	25
TOTAL	23,052	60	27	87	13

Source: U.N., *Enlargement of the Exchange Economy in Tropical Africa*, Tables 5 and 6, pp. 15 and 17.

and that in commercialized agriculture. The non-specialized nature of the peasant economy and the lack of homogeneity makes it difficult to measure the extent to which labour resources are divided between subsistence production and production for cash. Each farm has a portion of the land, the size of which varies with the degree of commercialization, devoted to food-crops. The percentage figures of the two modes of economic activity in the individual territories may, however, be taken as a guide to the degree to which production for cash has superseded subsistence food-crop production. Thus it will be seen that the Gold Coast has nearly two-thirds of its total adult population in commercialized agriculture. No other territory has more than one-third of its total population producing for cash, except Nigeria with 39 per cent. The main point which needs emphasis here is the overwhelming extent to which the indigenous African population still relies on primary agricultural production for both subsistence and cash. Only 13 per cent of the male population in the nine territories is engaged in wage-earning activities which fall outside, and are totally divorced from, the indigenous economic framework.

In the South-east Asian tropics the overall picture is similar. Although there are some minor light industries and manufacturing as well as mining, none of

1. 'Adults' are all those over 15 years of age.
2. This term covers not only agricultural activities, but also other modes of production such as fishing and cattle rearing.

these is of sufficient importance to alter the agricultural character of the region.[1] In most South-east Asian countries at least two-thirds of the total population are engaged in agriculture, and altogether about one hundred million fall within the peasant category.[2] The aim of peasant production is, as in tropical Africa, to provide enough food for the family, and subsistence agriculture (including subsistence fishing) predominates, even though the peasant may, to an increasing extent, grow some additional crops to meet his cash needs.[3] The main feature of South-east Asian agriculture is wet-rice cultivation. In Africa, roots, tubers, maize, and other dry land crops are predominant.

THE PRIMARY RURAL POPULATION OF MALAYA.

The influx of immigrants from China and India in the last century, consequent upon the opening up the country, changed the demographic structure of Malaya beyond all recognition, so that by 1947 the indigenous population (the Malays and Aborigines) had become a minority.[4] The motives behind this migration to the peninsula were largely economic. The majority of Chinese immigrants were occupied in money-earning activities in the tin industry, in rubber, and in business and commerce, while the Indians entered into the export economy as labourers in the rubber plantations. Only within the last two decades or so has there been any significant trend towards settlement on the land on traditional peasant lines by the locally born descendents of the immigrant population. This tendency has been more noticeable among the Chinese than among the Indians, although many of the former occupied State land without acquiring prior legal rights.

The Malays, on the other hand, have retained much of their peasant characteristics, being affected only to a minor extent by the establishment of a colonial export economy run on modern lines.[5] One of the reasons for this spirit of independence and self sufficiency is that the new economic structure based on western ideas was not superimposed upon, and did not displace, the existing Malay economic and social institutions, but rather co-existed with them. This, together with the British policy of 'indirect rule' has softened the western impact on customary Malay life.

Tables 3 and 4 show that agriculture occupied a very important place in the economy of Malaya in 1947, engaging nearly two-thirds of the total working population. Rubber cultivation and padi-planting were the most important of the agricultural activities, with 26.5 per cent and 24.7 per cent respectively of the total working population employed in these occupations. Only 10.4 per cent of the working population were occupied in all the other forms of agricultural activity. Fishing in Malaya is almost entirely a peasant occupation, and the 60,300 persons engaged in it in 1947 may all be included in the primary rural population category.

1. E.C.A.F.E., *Economic Survey of Asia and the Far East, 1950* (New York, 1951), p.173; also K.L. Mitchell, *Industrialization of the Western Pacific* (New York, 1942), p.168.
2. Firth, op. cit., pp. 503-4.
3. J.H. Boeke, *The Interests of the Voiceless Far East* (Leiden, 1948), pp. 37-48.
4. In 1947, the Malays and Aborigines formed only 44 per cent of the total Malayan population. Even if the immigrant Malays, i.e. 'Other Malaysians' are included, the percentage would still be only 50; M.V. del Tufo, *Malaya, Comprising the Federation of Malaya and the Colony of Singapore, A Report on the 1947 Census of Population* (London, 1949), p. 40.
5. J.P. Biddulph, for instance, comments as follows: 'For many years there has been a reluctance on the part of the Malays to resort to a wage-economy. They have preferred to live in the villages and only work to the extent which they considered necessary in order to live.' *Federation of Malaya, Annual Report of the Labour Department, 1953* (Kuala Lumpur, 1954), p.30.

Agricultural production in Malaya, on the other hand, is not dominated by peasant producers as it is in West Africa and in parts of the West Indies. Padi cultivation has been the mainstay of the Malay subsistence economy since historical times, and continues to be entirely a peasant interest mainly in the hands of the Malays. Market-gardening, stock-rearing, most types of fruit cultivation, except pineapple growing and minor food-crop cultivation, are also the monopoly of peasant farmers.

TABLE 3: EMPLOYED POPULATION OF MALAYA, 1947

	NUMBER OF PERSONS	PERCENTAGE OF TOTAL POPULATION
GAINFULLY EMPLOYED	1,904,100	39
NON-GAINFULLY EMPLOYED	2,974,000	61
TOTAL	4,878,100*	100

* Excluding the nomadic aboriginal population of 30,000.
Source: del Tufo, op. cit., p. 103.

TABLE 4: OCCUPATIONAL GROUPING OF GAINFULLY EMPLOYED PERSONS IN MALAYA, 1947

OCCUPATIONAL GROUP	NUMBER ENGAGED	PERCENTAGE OF TOTAL
AGRICULTURE		
RUBBER CULTIVATION	505,100	26·5
PADI CULTIVATION	470,600	24·7
OTHER AGRICULTURAL OCCUPATIONS*	198,900	10·4
FISHING	60,300	3·2
	1,234,900	64·8
ALL OTHER OCCUPATIONS	669,200	35·2
TOTAL	1,904,100	100·0

* Including coconut, oil-palm, pineapple and fruit cultivation, market-gardening, and stock-rearing.
Source: del Tufo, op. cit., Table 78, pp. 442-5.

However, in the case of five major revenue crops, production is divided between estates and peasant smallholdings (Table 5). Oil-palm and tea are grown in estates only, while rubber, coconuts and pineapples are cultivated in estates as well as peasant holdings. It is necessary, therefore, when assessing the number of peasant producers, to deduct the number of labourers and salary earners, including employers and managers, in the estates from the total working population engaged in the agricultural occupations. The total number of such employers, managers and labourers in 1947 was 485,018. The remainder, composed of 'own account workers' and 'unpaid family workers' may be classed under the primary rural population category. The situation is summed up in Table 6. The total primary rural population in 1947 formed 39.4 per cent of the total gainfully employed population. The rest of the working population were employed outside the peasant agricultural economies—25.5 per cent as wage-earners in the estates and the remaining 35.1 per cent as wage-earners in nine industrial categories: mining and quarrying, manufacturing, transport and communication, commerce

TABLE 5: AREA UNDER RUBBER, COCONUT, PINEAPPLE, OIL-PALM AND TEA IN MALAYA, 1950-54 (THOUSANDS OF ACRES)

YEAR		1950	1951	1952	1953	1954
RUBBER	ESTATES	1,964	1,964	1,997	2,030	2,028
	SMALLHOLDINGS	1,394	1,571	1,616	1,698	1,472
COCONUT	ESTATES	95	96	97	95·5	95
	SMALLHOLDINGS	389	388	388	389·5	403
PINEAPPLE	ESTATES	N.A.	N.A.	N.A.	9	9·5
	SMALLHOLDINGS	N.A.	N.A.	N.A.	15	18
OIL-PALM	ESTATES	96	97	100	108	109
	SMALLHOLDINGS	NIL	NIL	NIL	NIL	NIL
TEA	ESTATES	8	9	9	9	9
	SMALLHOLDINGS	NIL	NIL	NIL	NIL	NIL

N.A. = information not available.

Note: Holdings of more than 100 acres are classified as 'Estates' and holdings of less than 100 acres are 'Smallholdings'.

Sources: *Federation of Malaya, Annual Reports of the Department of Agriculture* for the years 1950 to 1954; *Malaya, Rubber Statistics Handbook, 1954* (Kuala Lumpur, 1956); and *Monthly Statistical Bulletins of the Federation of Malaya, 1950 to 1956.*

TABLE 6: THE GAINFULLY EMPLOYED POPULATION OF MALAYA IN 1947, CLASSIFIED ACCORDING TO THE NATURE OF WORK

CATEGORY	NUMBER OF PERSONS	PERCENTAGE OF TOTAL GAINFULLY EMPLOYED POPULATION
(1) TOTAL PRIMARY RURAL POPULATION ENGAGED WITHIN THE PEASANT AGRICULTURAL ECONOMIES.	749,900	39·4
(2) TOTAL ENGAGED IN OUTSIDE WAGE-EARNING BUT WITHIN THE AGRICULTURAL ECONOMIES (I.E. ESTATE WORKERS)	485,000	25·5
(3) TOTAL ENGAGED IN OUTSIDE WAGE-EARNING (IN NON-AGRICULTURAL EMPLOYMENT)	669,200	35·1
	1,904,100	100·0

Source: Tables 3 and 4 and del Tufo, op. cit., Table 102, p. 532.

and finance, public administration and defence, professional service, entertainment and sport, personal service and 'other indeterminate industries'.

The primary rural population numbered approximately 750,000 adults in 1947. The position in the years after the 1947 Census cannot be ascertained because of the lack of statistics, but it is not expected that the overall pattern of employment would have changed to any great extent. The most important factor that could alter the 1947 structure of employment, and consequently the numbers of the primary rural population, is the siphoning off of a section of the adult population (especially the Malays) into the security forces when the armed struggle against the Communists began in 1948. In 1952, at the height of the Emergency,

the police force had a total strength of 73,000 as compared with 11,000 in 1947.[1] With the lessening of tension in recent years, the total has fallen progressively to 63,000 in 1953, 50,000 in 1954 and to 47,600 in 1955.[2] The recruitment of adult males into the armed forces may thus be considered a temporary measure not likely to affect the general picture as depicted for 1947.

THE RACIAL COMPOSITION OF THE PRIMARY RURAL POPULATION.

Due to the immigrant character of the Malayan demographic structure, the outline of the numbers and relative importance of the peasant population would be incomplete without tracing at the same time the racial composition of the population. Whereas in many parts of tropical Africa it would be true to say that the peasant population is composed mainly of indigenous Africans, the same generalization cannot be applied to Malaya with its multi-racial society, as Table 7 indicates.

TABLE 7: THE RACIAL COMPOSITION OF THE POPULATION OF MALAYA, 1947-55

YEAR	TOTAL POPULATION	PERCENTAGE OF TOTAL POPULATION			
		MALAYS	CHINESE	INDIANS	ALL OTHERS
1947	4,908,086	49·5	38·4	10·8	1·3
1950	5,226,549	49·4	38·5	10·9	1·2
1953	5,705,952	49·1	37·7	11·6	1·6
1955	6,152,099	49·2	37·7	11·5	1·6

Source: *Monthly Statistical Bulletin of the Federation of Malaya, December, 1956* (Kuala Lumpur, 1956), p. 3.

The Malays[3] averaged less than half the total population. The remainder was made up of Chinese (averaging 38 per cent), Indians (11 per cent) and miscellaneous other races numerically insignificant. The relative positions of the two main racial groups and the Indian minority in agriculture and fishing are shown in Table 8. It will be observed that four-fifths of the Malay population employed in agriculture and fishing were engaged in peasant production within the agricultural economies, either in subsistence wet-padi cultivation or as smallholders growing rubber, coconut, or fruit for cash. The other one-fifth were labourers engaged in wage-earning in the various estates. Approximately two-thirds of the wage-earners were immigrant Malaysians. If the indigenous Malays alone were considered then the number engaged in outside wage-earning would drop from 20 per cent to 17 per cent.[4] The position in Malaya would then be markedly similar to that in tropical Africa, where 13 per cent of the indigenous Africans in nine African territories were wage-earners in 1950 (see Table 2).

Not only did the Malays as a whole have a greater proportion of their population in the peasant economy, but they were also the numerically dominant racial group within the economy, as illustrated in Table 9.

1. *Federation of Malaya, Annual Report, 1953* (Kuala Lumpur, 1954), p.223.
2. *Federation of Malaya, Annual Report, 1955* (Kuala Lumpur, 1956), p.293.
3. The Malays are subdivided into 'Malays Proper' and 'Other Malaysians' i.e. immigrants from Indonesia. Because of the similarity in religion, cultural and economic habits, the 'Other Malaysians' are difficult to distinguish from the 'Malays Proper'. Politically they are treated as Malays and are given the full political privileges accorded to indigenous Malays. There are therefore no barriers separating these two groups; in fact most of the immigrant Malays are rapidly absorbed into the local Malay cultural landscape. See del Tufo, op. cit., pp.72-4 and T.E. Smith, *Population Growth in Malaya* (London, 1952), pp.14-25. The word 'Malay' in the context of this study refers to both groups.
4. del Tufo, op. cit., Statement B, p.112.

TABLE 8: TOTAL POPULATION ENGAGED IN AGRICULTURE AND FISHING ACCORDING TO RACIAL GROUPS, MALAYA, 1947

RACE (1)	ENGAGED IN AGRICULTURE AND FISHING (2)	ENGAGED AS PEASANT SMALL-HOLDERS WITHIN AGRICULTURAL ECONOMIES (3)	PER-CENTAGE OF (2) (4)	ENGAGED IN OUTSIDE WAGE-EARNING, BUT WITHIN THE AGRICULTURAL ECONOMIES (5)	PER-CENTAGE OF (2) (6)
MALAYS	687,000	555,000	80	132,000	20
CHINESE	354,000	181,000	51	173,000	49
INDIANS	183,000	6,000	3	177,000	97
ALL OTHERS	11,000	8,000	73	3,000	27
TOTAL	1,235,000	750,000	60	485,000	40

Source: Table 6, and del Tufo, op. cit., Table 78, p. 442 and Table 102, p. 532.

TABLE 9: THE RACIAL COMPOSITION OF THE PRIMARY RURAL POPULATION, MALAYA, 1947

RACE	MALAYS	CHINESE	INDIANS	ALL OTHERS	TOTAL
NUMBER	555,000	181,000	6,000	8,000	750,000
PERCENTAGE	74	24	1	1	100

The position of the Chinese peasant population as depicted in Tables 8 and 9 reflects the nature and character of their economic interests in Malaya. The early Chinese immigrants came into the country for the purpose of monetary gain, working in the tin-mines, cultivating cash-crops such as sugar, pepper, gambier, cloves, nutmegs and rubber. They also occupied an important place in the trade and commerce of the country. A few who achieved their objective returned to China. Most of the others sent their earnings to their families and relatives but remained for some time in the Peninsula.

Chinese migration to the Malay Peninsula before the establishment of the *pax Britannica* was insignificant in terms of numbers.[1] After the establishment of settled conditions large scale emigration from South China to the Malay States took place, reaching a peak towards the end of the nineteenth century.[2] This coincided with the rapid opening up of the country, when the work of clearing the jungle and building new lines of communication between the coast and the interior to serve the tin-mines was undertaken. Except during periods of economic depression the movement of Chinese to Malaya continued on a very large scale up to the outbreak of the second world war.[3]

1. There were only 1,390 Chinese in Malacca in 1760, and 3,000 in Penang in 1794. V. Purcell, 'Chinese Settlement in Malacca', *J.M.B.R.A.S.* Vol. XX, No. 1, 1947, p.125.
2. G.T. Hare in *Federated Malay States, Census of the Population, 1901* (Kuala Lumpur, 1902), p.49, states that the total Chinese immigration into the F.M.S. during the nineteen years between 1881 and 1900 was nearly two million.
3. The first census to be taken for the whole of Malaya, including Singapore, was in 1911. The total Chinese population then stood at 693,000 (excluding Singapore), see H. Marriott, *Report on the Census of the Colony of the Straits Settlements, 1911* (London, 1911), Table II, p.94. By 1921 it had risen to 856,000 and by 1931 to 1,285,000; in 1947 the figure stood at 1,884,500. Figures from del Tufo, op. cit., p.40.

The temporary nature of Chinese migration to Malaya, at least during the earlier phase of the country's economic development, is reflected by the ill balanced sex ratio[1] and by the low percentage of the Chinese population who were born locally. In 1891, there were only 153 Chinese women to every 1,000 Chinese men in the Straits Settlements.[2] In the Federated Malay States in 1901, there was an average of 100 Chinese women to every 1,000 Chinese men, and in 1911 the average rose to 187.[3] In the census years 1891 and 1901, only 15 per cent of the total Chinese population in the Straits Settlements were born locally,[4] while in the Federated Malay States only 2 per cent of the total of the 163,000 Chinese enumerated in 1891 and the 299,739 enumerated in 1901 were local-born.[5]

The original purpose of Chinese migration was not permanent settlement. The majority who came to Malaya did so without any deliberate intention of breaking their family ties in China, it was rather to sojourn a few years in the peninsula and return to the homeland as soon as they had made enough money to have rendered their stay profitable. Farming was mainly for cash-crops and not for subsistence, a contrast to the normal set-up in their villages in China. Farming methods as practised for cash-crop cultivation in the early years were not far removed from that of shifting cultivation, a destructive system of 'land-mining' tolerated, if not actively encouraged, by the authorities, in a country where land was plentiful.[6] Padi cultivation, the traditional agricultural backbone of South China, was also the mainstay of the Malay subsistence economy. But the Chinese migrants did not show any interest in padi-planting as it was the most unremunerative of all agricultural occupations in Malaya.[7]

The situation began to change soon after 1930. Chinese migration into Malaya became less extensive and finally, after the last war, slowed down to a steady but small flow. There were a number of reasons for this. Firstly, during the Great Depression the Aliens Ordinance was passed which severely limited, and later stopped, the entry of Chinese male labour, but it allowed the unrestricted entry of females. The large scale immigration of women into Malaya following Japan's invasion of China vastly improved the sex ratio of the Chinese population, and encouraged the setting up of families in Malaya. It also encouraged the formation of new social links in the country and led to the decay of old ones in China. Secondly, the creation of extensive economic ties and interests, and the guaranteed protection of these by a paternal government, made the Chinese reluctant to leave Malaya and abandon the fruits of many years of labour. Life, even for the common labourer, was certainly much easier in the rapidly developing Peninsula than in the old villages of China. Finally, the immobilization of traffic

1. The reasons why the Chinese immigrants did not bring their women-folk were; (a) because they preferred to leave their wives and children at home, (b) for economic reasons, and (c) because the Chinese authorities at first prevented women from going overseas. V. Purcell, *The Chinese in Malaya* (Oxford, 1948), pp.85-6.
2. J.R. Innes, *Report on the Census of the Straits Settlements, 1901* (Singapore, 1901), pp.22, 60, 119.
3. A.M. Pountney, *The Census of the Federated Malay States, 1911* (London, 1911), p.28.
4. Innes, op. cit., pp.14, 15, 19, 28, 68, 124.
5. Pountney, op. cit., Tables III and IV, pp. 56-7.
6. Sir Frank Swettenham, 'Malay Problems, 1926', *British Malaya,* Vol. 1, No. 1, p.12.
7. *Federated Malay States, Report of the Rice Cultivation Committee, Vol. II* (Kuala Lumpur, 1931), App. I, p.27. This does not mean that the Chinese did not cultivate the crop at all, in point of fact, some padi-lands in Malacca have had a long tradition of Chinese cultivation, See J.R. Logan, 'Journal of an Excursion from Singapore to Malacca and Penang', *Essays Relating to Indo-China, Vol. I* (London, 1887), p.19; and J. Low, *A Dissertation on the Soil and Agriculture of the British Settlement of Penang* (Singapore, 1836), pp.82-3. In general padi cultivation by Chinese peasants before the second world war was insignificant in terms of area.

between South China and Malaya over the long period from the beginning of the Japanese occupation of the South Chinese ports, in 1937, to the end of the war in the Pacific, and the Communist conquest of China, in 1949, forced many Chinese who would normally have returned to their homeland to stay on, and at the same time, fostered and strengthened the economic and social bonds holding them to Malaya.[1] A new generation of local-born Chinese came into being. The overall tendency to permanent settlement is indicated by the improvement in the sex ratio and the greater percentage of local-born Chinese recorded by the last census.[2]

Table 8 shows that, of the 354,000 Chinese engaged in agriculture and fishing, one-half were wage-earners, and the other half peasant smallholders engaged in primary production, with the family as the basic unit. These 181,000 Chinese peasant smallholders, however, constituted only 25 per cent of the total Chinese working population of 717,000 in 1947.

The principal occupations of the Chinese working population, apart from agriculture and fishing, were: wage-earning in estates (173,000); mining and quarrying (35,000); manufacturing and repairing of machines, etc., (26,000); other types of manufacturing, including food, clothing, woodworking, rubber milling, packing, etc., (60,000); building and decorating (10,000); transport and communications (27,000); commerce and finance (117,000); public administration (13,000); and personal, professional and other services (75,000).[3] Thus, while they played an important part in all the major industries, the Chinese were most important in agriculture, mining, commerce and finance.

The Chinese peasant population in 1947, as depicted in Table 9, was very much smaller than the Malay peasant population, constituting only one-quarter of the total Malayan peasant population of 750,000. The other three-quarters were Malays. Not only did the Chinese peasant population differ widely from the Malay in terms of numbers, but they differed also in the aims of their occupations. The emphasis in Chinese holdings, as would be expected, was much more on commercialized production and less on subsistence, see Table 10.

An entirely subsistence economy does not exist in Malaya today, except amongst the Aborigines. The Malay in even the most remote areas participates to some extent in the money economy by selling jungle produce and purchasing food, tobacco and other commodities. We are therefore dealing with relative degrees of subsistence, and in Malaya the population group that cultivates padi can be considered as having an economy nearest in characteristics to the subsistence economy, for the reason that in most of Monsoon Asia where rice forms the staple, rice and food are synonymous. To have rice is to have the basis of subsistence; all else is subsidiary. Although padi cultivation is to some extent commercialized, especially in the plains of Krian, Sungei Manik, and Tanjong Karang, in all cases the amount necessary for the sustenance of the family is deducted before the surplus crop goes to the market. The peasant is thus assured of enough food until the next harvest. Looked at from another viewpoint, this is merely an extension of the traditional subsistence economy. The only difference between the situation now and when an entirely subsistence economy was in force is that formerly any surplus rice was exchanged for other commodities; now it is sold for cash and the other commodities bought from the proceeds. True, there

1. T.H. Silcock and Ungku Aziz 'Nationalism in Malaya' in W.L. Holland (ed.) *Nationalism and the West* (New York, 1953), pp.276-7.
2. The number of females to every 1,000 males was 371 in 1921; 486 in 1931; and 815 in 1947. The percentage of Chinese born in Malaya (percentage of the total Chinese population) was 20.9 in 1921; 29.9 in 1931; and 63.5 in 1947. del Tufo, op. cit., pp.57, 84.
3. Ibid, Table 78, pp.442-5.

TABLE 10: THE NUMBER OF MALAYS AND CHINESE ENGAGED IN FISHING, PADI CULTIVATION, MARKET-GARDENING AND OTHER PEASANT OCCUPATIONS IN MALAYA, 1947

OCCUPATION	MALAYS	CHINESE
FISHING	41,500	18,000
PADI CULTIVATION	417,000	45,000
MARKET-GARDENING (A)	16,000	86,000
STOCK-REARING (B)	1,000	6,000
FRUIT CULTIVATION (C)	1,000	1,000
OTHERS	10,000	17,000
TOTAL	486,500	173,000

(A) Includes vegetable and tapioca growing.
(B) Includes dairy, pig and poultry farming and fish-rearing.
(C) Excludes pineapple cultivation.
Source: del Tufo, op. cit., Table 78, p. 442.

is now a greater range of goods to be bought, and there are also the subtleties of supply and demand, and price fluctuations concomitant with a money economy, but otherwise the picture remains basically the same as it was in earlier times.

At the other end of the subsistence scale are the Chinese and Malay rubber smallholders, whose crops cannot be consumed but must first be sold before rice and other essentials can be obtained. To this group belongs also the Gold Coast cocoa farmer, the Nigerian cotton-growing peasant, and the other tropical peasants whose main crops are not subsistence crops. In the scale between the padi-planter and the rubber smallholder are the peasants whose economies form intermediate variations.

The relative importance of subsistence production as gauged by the extent to which each racial group engages in padi-planting is seen in Table 10. It is apparent that padi is the dominant interest of the Malays, there being 417,000 Malay planters as compared with only 45,000 Chinese. Padi cultivation, together with fishing, have been the traditional bases of Malay existence, and the fact that 68 per cent of the total Malay working population (84 per cent of the total Malay primary rural population) in 1947 were engaged in these two occupations is evidence of their continued pre-eminence in the Malay rural landscape.

Table 10 also confirms the fact that the Chinese are more interested in cash-crop than subsistence production. There were only 63,000 Chinese (18 per cent of the total Chinese working population, or 35 per cent of the total Chinese primary rural population) in padi cultivation and fishing. However, the Chinese predominated over the Malays in the other peasant occupations, especially in market-gardening.

Although there were 183,000 Indians engaged in agriculture and fishing in 1947 (Table 8), most of them were wage-earners employed mainly in the rubber estates, and in the coconut and oil-palm plantations. The history of Indian immigration in Malaya is closely connected with the establishment and growth of the rubber industry. The impact of the Indians on the economic landscape is markedly different from that of the Chinese. The large scale migration of the Chinese into the Peninsula derived its original impulse from tin-mining, but the interests of later Chinese migrants expanded to include all the major economic activities. The original motive of Indian migration was wage-earning in the rubber estates, and during the last fifty years there has been only a slight diversification of economic interests, notably in the direction of commerce and finance. Wage-

earning in estates remains the dominant occupation of Indians in Malaya, as indicated by the fact that Indian manual workers and other wage-earners in estates averaged 50 per cent of the total labour force of between 294,000 and 318,000 in the years 1950-54.[1] Only 6,000 Indians were classed as peasant smallholders in 1947, forming less that 1 per cent of the total Malayan primary rural population (see Tables 8 and 9). Apart from wage-earning in estates (177,000 in 1947), the rest of the Indian working population were found in the following occupations: mining and quarrying (6,000); all forms of manufacturing (11,000); transport and communications (14,000); commerce and finance (26,000); public administration (35,000); personal and professional services (23,000) and other indeterminate occupations (2,000).

The position of the other diverse races in Malaya is similar to that of the Indians in that only 8,000 of them in 1947 were engaged in peasant occupations. This number constituted about 1 per cent of the total Malayan primary rural population. Nearly all of these were padi-planters, and most of them were of Siamese extraction. Because their mode of living in many respects parallels that of the Malays, this group of peasants fits well into the indigenous setting, and may be considered as part of the Malay peasant population. The 1,151 Europeans, who were engaged in the agricultural industries in 1947, were all either employers or managers in estates: 1,042 in rubber; 26 in coconut; and 44 in oil-palm estates; the rest were in other miscellaneous agricultural enterprises.

THE DISTRIBUTION OF THE PRIMARY RURAL POPULATION

An analysis of the historical evolution of the human geography of Malaya is essential to an understanding of the distribution of the peasant population.

The landscape of human occupance in the Peninsula before its transformation consequent upon the establishment of British rule was relatively simple. On the coastal swamps flanking the central mountain ranges, and on the forested slopes of the ranges, lived the Aborigines who engaged in hunting, food gathering and shifting cultivation. They were racially akin to the primitive groups in other South-east Asian countries and had similar modes of living. The 1947 Census numbered them at 34,737, but recent revision indicates their number to be nearer 100,000.[2] Their distribution, however, can be fixed with greater certainty, though allowance must be made for their nomadic habits. Towards the northern parts of the Peninsula were several distinct tribes of Negritoes known as Semang in Perak, and Pangan in Kelantan. These are similar in anthropological characteristics to the Negritoes of New Guinea, the Philippines, the Andaman Islands and Indonesia. They were numerically the least significant of the Aborigines. Their traditional habitat was the coastal forests and swamps that border the Main Range in Upper Perak, Kelantan and Trengganu, but their wanderings sometimes led them south to the jungles of Pahang. Practising no agriculture, they were completely dependent for their subsistence on wild fruits and roots, supplemented by game. Their crude, easily erected shelters bore testimony to the nomadic nature of their existence.[3] With the invasion of Malays and later of Chinese on their land, the Negritoes have been gradually pushed further into the interior towards the remote flanks of the Main Range, whilst many smaller tribes have

1. *Federation of Malaya, Annual Report, 1954* (Kuala Lumpur, 1955), Table B, p.32.
2. *The Times*, 20th February, 1952.
3. N. Annandale and H.C. Robinson, *Fasciculi Malayenses* (Liverpool, 1903), pp.19-20; also W.W. Skeat and C.O. Blagden, *Pagan Races of the Malay Peninsula, Vol. 1* (London, 1906), p.53; R.J. Wilkinson, *A History of the Peninsula Malays* (Singapore, 1920), p.2; L.R. Wheeler, *The Modern Malay* (London, 1928), p.41.

died out altogether in recent years. The change of environment from the coastal lowlands to the hilly slopes brought them into contact with the Senoi (and other related groups such as the Ple-Temiar, Temiar, Semak, Sisek and Semelai). Evidence of this contact is found in the adoption of Senoi ways of life, and of the blowpipe as a hunting weapon.[1] Their hunting and food-gathering economy made no material impact upon the landscape.

The largest of the Aboriginal groups collectively known as the Senoi (or Sakai) roamed the slopes and foothills of the central ranges, and seldom ventured onto the plains. The Senoi had a more advanced economy than the Negritoes, and practised some form of *ladang* or shifting cultivation in addition to hunting and food-gathering. Their system of agriculture exhibited characteristics similar to those of the shifting cultivation system practised in other tropical areas. It depended on the periodic clearing of a patch of jungle and the cultivation of some food-crops such as hill padi, root crops, bananas and perhaps tobacco. Soil exhaustion, as evidenced by poor yields, would lead to the abandonment of the area (usually after two or more years) and the clearing of a new patch. The area of land cleared seldom exceeded two acres per family. Their houses were more substantial than the leaf-shelters of the Negritoes. Their movements during the cultivation period were not restricted to dwelling and *ladang* patch, but hunting and gathering expeditions necessitated excursions into the forest. The total acreage of the *ladang* patches appeared insignificant when compared with the vast stretches of forest. It has been estimated that these patches totalled less than 10,000 acres in any one year.[2] The *ladangs* were frequently separated one from the other by miles of jungle.

The third group of Aborigines were the Jakuns (or Proto-Malays) who were of Mongoloid stock. The chief subdivisions of this group were: the Mantera and the Biduanda, both located in Negri Sembilan and Malacca; and the Orang Ulu, Orang Kanak and Orang Laut of Johore. They were confined to the southern lowlands of the Peninsula and had a culture akin to that of the lowland Malays. Their dialects showed recognizable traces of several centuries of contact with the historical Malay tongue.[3] It has been advocated that they formed the original stock from which many of the southern Malay peoples of the Peninsula were derived.[4] They practised *ladang* agriculture. Some tribes were settled in fishing villages on the west coast of Johore. These were the Orang Laut (Malay for 'sea-folk') living a semi-amphibious existence, and notorious in those days as pirates. Many of them have been assimilated into the Malay groups, the rest being distributed in the more remote swamps and jungles of south Malaya.

The population density of all these Aboriginal groups varied considerably. Large tracts of jungle were entirely uninhabited, while small pockets of temporary settlement in the *ladangs* might have a density of anything from five to twenty persons per square mile. The impact of their economy on the natural landscape was negligible. The *ladang* system of successive clearings did not result in any large scale transformation of jungle into savannah as in tropical Africa, mainly because there was no pressure of population on the land.

The other major population group, apart from the Aborigines, was formed by the Malays (known also as Deutero-Malay or Coastal Malay). Ethnically

1. Sir Richard Winstedt, *The Malays, A Cultural History* (London, 1950), p.8.
2. E.H.G. Dobby, in *The Development of Upland Areas in the Far East, Vol. II* (New York, 1951), p.5. Assuming that each family cultivated two acres, the 6,300 odd families enumerated in the 1947 Census would cultivate a total area of some 12,000 to 13,000 acres in any one year.
3. Wilkinson, op. cit., p.11; Winstedt, op. cit., pp.16-17.
4. Winstedt, op. cit., p.15.

resembling the Malays of Indonesia, the Malay in the Peninsula is a 'broad-headed individual with more or less Mongoloid features, olive skin, lank black hair and thin beard', and is descended from the 'Proto-Malay plus many foreign strains derived from intermarriage with Chinese from the Chou period onwards, with Indians from Bengal and the Deccan, with Arabs and Thais.'[1]

The distribution of the Malays had a definite pattern, which was related to the physical geography of the country. The dominant physical feature in the Peninsula is the series of mountain ranges aligned in a north-west to south-east direction (Fig. 1). These determine the major drainage lines, each of which, with the exception of the Kelantan River, tends to follow a longitudinal course in its upper reaches before making a right-angled bend at the break of slope to flow out to sea on one side or the other of the Peninsula.[2] The heavy and uniform rainfall gives rise to a multiplicity of rivers which are generally narrow and swift in the upper courses, and slow and meandering where they flow across the broad flat plains flanking the mountainous core. These rivers in their turn set the original pattern of Malay settlement on the lowlands and coastal areas. The easiest lines of movement in that repellant landscape of lowland swamp and forest were along the rivers. Wet-padi cultivation, the basis of Malay agriculture, also tended to draw the Malays towards flat land located near to a convenient source of water supply. The sea and rivers served as sources of fish, and the rivers provided potable water. All these considerations contributed to the attraction of settlement to sites located near water bodies, especially to riverine areas. When the Malays first found their way to the Peninsula, either overland or by sea from Indonesia, the river mouths were the foci of settlement. From these central spots expansion later took place either coastwise or up the rivers, or, more usually, in both directions. Malay settlements, in contrast to the amorphous nature of the Aboriginal groupings, thus assumed a definite form and shape derived from ribbon development along the coast and along river banks.

Malay houses tended to be built on levees and permatangs away from flood risks, and, as an additional safeguard, to be raised on stilts. Some Malays, the river-dwellers, made their homes in dug-out canoes and rafts in which they travelled up and down the river trading and fishing. Others, the pile-dwellers, who were fishermen, built their houses on platforms raised on stilts, and lived an amphibious life.

The mouth of a major river was a strategic location, commanding lines of movement both coastwise and along the rivers. The old Malay political independencies were sited at these focal points for military as well as economic reasons.[3] The head of each riverine state was the Raja (or Sultan) who wielded absolute power. Each sultanate was separated from the next by forested interfluves which acted as no man's land, but there were no well defined boundaries to indicate where one ruler's control ended and the other's began. The effective control of the sultans stopped at the limits of cultivation of the furthest kampong or village. There was a considerable number of these isolated petty kingdoms during the eighteenth century, and it was by a slow process of absorption of weaker sultanates by stronger ones that the nine Malay States which exist today came into being.

The Malays followed a simple subsistence economy founded on sedentary agriculture with wet-padi as the main crop and with fish as the chief supplement.[4]

1. Ibid.
2. E.H.G. Dobby, *Southeast Asia* (London, 1950), Fig. 32, p.96.
3. At the mouth of each river and tributary the local chief had a customs station where duties on goods were exacted. R.O. Winstedt 'A History of Malaya, Pt.I', *J.M.B.R.A.S.*, Vol. XIII, 1935, p.237.
4. G.E. Shaw, 'Rice Planting', in R.J. Wilkinson (ed.), *Papers on Malay Subjects* (Kuala Lumpur, 1911), No. 5, Pt. III, p.1.

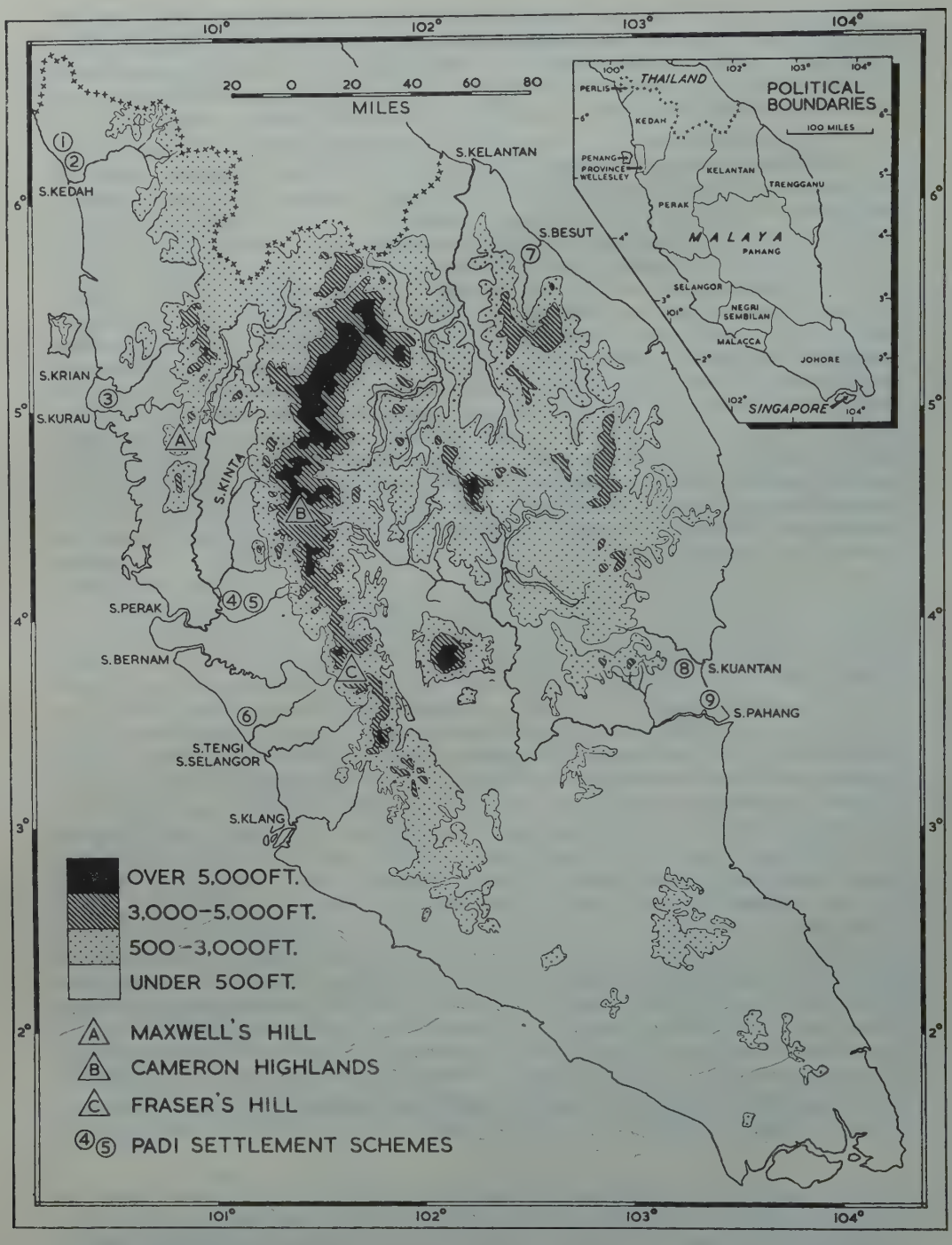

Fig. 1. Relief, and Padi Settlement Schemes, Malaya. 1. South Perlis, 2. Kubang Pasu, Kedah, 3. Krian, Perak, 4. Sungei Manik, Perak, 5. Changkat Jong, Perak, 6. Tanjong Karang, Selangor, 7. Besut, Trengganu, 8. Paya Besar, Pahang, 9. Pahang Tua, Pahang.

Any extra produce available from the farms would be traded at the rural fairs. The average Malay peasant padi holding was about 2.5 acres, enough padi being produced to feed a family of six and leave a small surplus for exchange or trade.[1] There was no pressure of population on the land. The self-subsistence economy had a flexibility which solved increases in population by bringing more land under cultivation. The total population at this period was between 200,000 and 250,000. The total area under cultivation was estimated to be around half a million acres.[2]

The transformation of this pattern of population distribution began in the middle of the last century with the discovery of tin deposits in western Malaya and the influx of miners, mainly Chinese, in large numbers. The establishment of the *pax Britannica,* which began in 1874 with the Treaty of Pangkor, provided the conditions of stability necessary for economic development.[3] The exploitation of the tin deposits, which began as a Chinese monopoly, later attracted the attention of European interests as the civil disturbances in the Peninsula were put down.[4] The Chinese tin monopoly was soon broken. Seventy-eight per cent of the production in 1910 came from Chinese mines and the rest from European mines, by 1930 the European mines were producing 63 per cent as against 37 per cent by the Chinese.[5]

The early miners had to face, among many other problems, the difficulty of gaining access to the stanniferous deposits along the western foothills of the Main Range. The mountains are bordered on both sides by a foothill zone of undulating land varying in height from 50 to 500 feet. Away from this zone and stretching to the coast is a region of intermittent freshwater swamp, the breadth of which may approach forty miles. This swamp zone runs from Kedah in the north to Johore in the south, forming a more or less continuous longitudinal belt. As the easiest means of access was along the rivers, they became the main links between the mining settlements and the ports. But river transport was slow and arduous; the channels were shallow and meandering, and progress was constantly interrupted by obstructions such as sunken timber, sand bars, and sometimes by floods.[6] Later, as the volume of traffic increased and a more reliable means of transport had to be found, short railway lines were built between coast and foothills. The foci of mining activities were then the Larut district of Perak and the Klang river area of Selangor. The mining settlements were the nuclei of the present day towns of Taiping and Kuala Lumpur respectively. Short railway lines were constructed from Larut to Port Weld and from Kuala Lumpur to Klang. Between the years 1885 and 1903 the railway line was extended northwards from Kuala Lumpur and southwards from Taiping, running along the foothill zone where the main tin deposits were to be found. Eventually the two towns were linked by a single line. The main network of the present day railway system was completed in 1935. One arm of the network runs along the western flank of the Main Range from Perlis to Gemas, and continues southward to Johore Bharu and across the causeway to Singapore. From Gemas another arm runs northward along the eastern flank

1. Winstedt, *The Malays, A Cultural History,* pp.126, 131-4.
2. Purcell, *The Chinese in Malaya,* p.xi; Dobby, *Southeast Asia,* p.128.
3. Sir Frank Swettenham, *British Malaya, An Account of the Origin and Progress of British Influence in Malaya* (London, 1948), and Winstedt, 'A History of Malaya, Part I', passim.
4. For a first-hand account of the civil wars and state of friction between rival sultanates, see F.A. Swettenham, *Some Account of the Independent Native States of the Malay Peninsula* (Singapore, 1880).
5. Sir Lewis Fermor, *Report upon the Mining Industry of Malaya* (Kuala Lumpur, 1939), Table 18, p.64.
6. Ooi Jin-bee, 'Mining Landscapes of Kinta', M.J.T.G., Vol. 4, 1955, pp.21-3.

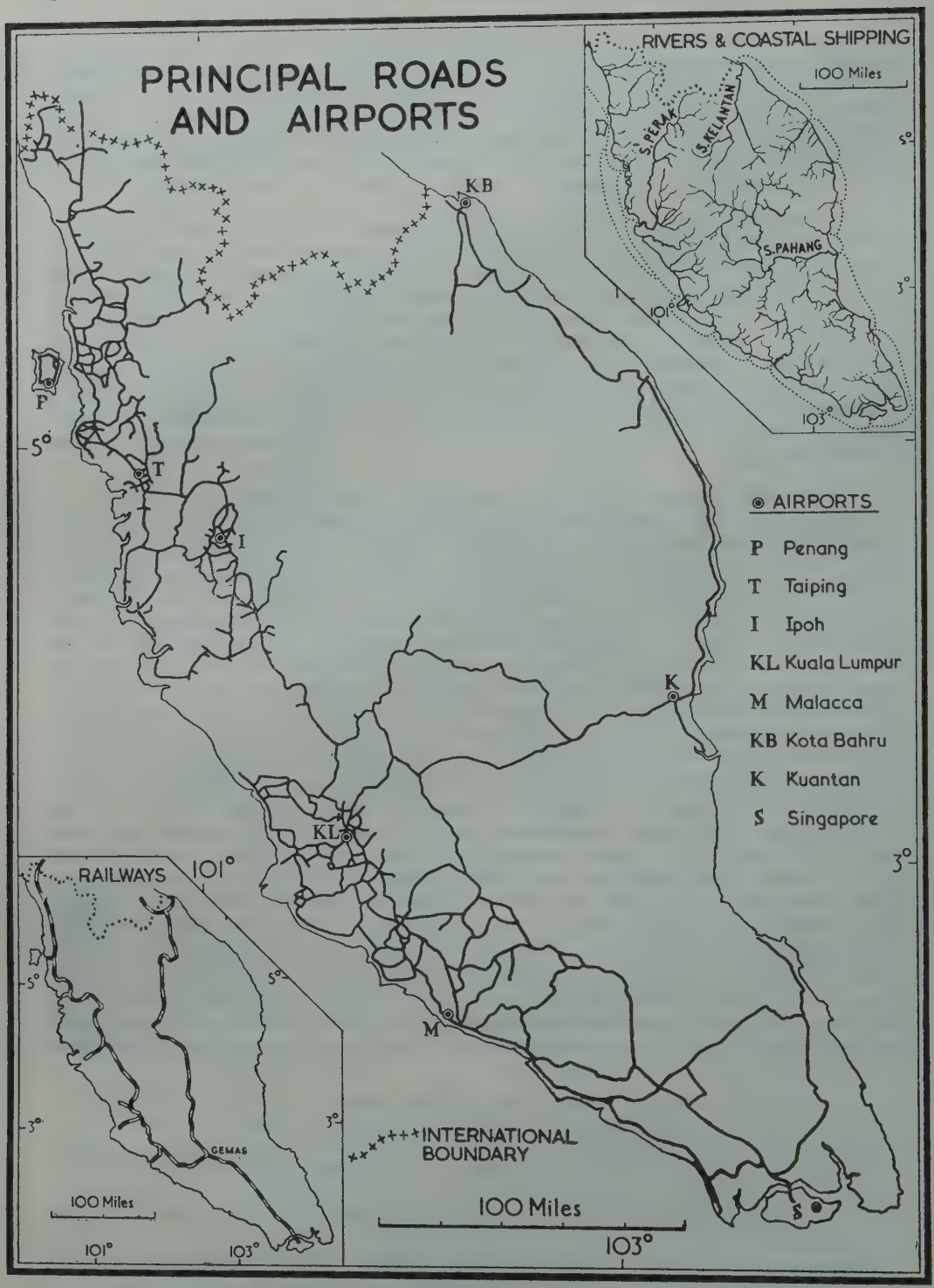

Fig. 2. Communications, Malaya.

of the Range to Tumpat in Kelantan. Latitudinal off-shoots of the western line join the inland towns to the ports. The eastern line, however, has no branch lines between the coast and the foothills (Fig. 2).[1]

The earliest roads were but footpaths and tracks connecting river landing places to mining fields, and were used by porters and elephants.[2] As the rivers lost their earlier significance and railways superseded them, the roads took on a new role by acting as feeders to the railways. The modern roads were not laid until after the introduction of motor transport at the beginning of this century, when many of the cart-tracks were broadened and metalled. The present road network is best developed along the west coast, being particularly dense along two zones—one from central Selangor southwards to Malacca, and the other from the Kinta Valley northwards to Butterworth—both are zones of intense mining and rubber cultivation. The western road network closely parallels that of the railway. Roads east of the Main Range do not follow the railway line, but tend to run from east to west, with a trunk road joining Kuantan to Kuala Lumpur, and another linking Endau and Mersing to the main north-south line at Kluang and Johore Bharu. The only other major road runs coast-wise from Tumpat in Kelantan to Nenasi in Pahang.

The other major development that took place soon after the tin rush, bringing with it further and more extensive changes in the economic and social structure of Malaya, was the introduction of rubber towards the end of the century.[3] Given the demand for rubber and its products in world markets, the successful establishment of the rubber tree depended on three other main factors: (1) suitable conditions of soil and climate; (2) cheap and efficient transport; and (3) a cheap and abundant labour supply. Natural conditions of soil and climate in the Peninsula were found to be ideal for the growth of the tree, especially on the well drained soils of the foothills.[4] The skeleton of an excellent railway and road system had already been laid to serve the mining industry, and cheap labour was available from south India. The combination of a good transport system and well drained soils along the foothill zone, as well as proximity to the deep water ports of Penang and Port Swettenham as points of entry and exit for labour and rubber, probably served more than anything else to concentrate rubber cultivation on the western side of Malaya. In 1897 there were only 345 acres of rubber in the whole of Malaya; by 1905 there were 50,000 acres. The history of rubber cultivation is one of constant expansion during periods of boom prices punctuated by shorter periods of stagnation due to depression prices, but on the whole the result has been one of ever increasing acreage. Its importance to the economic health of Malaya can be gauged by the following statistics. In 1953 rubber occupied

1. A detailed account of the evolution of the railway system of Malaya is given by C.A. Fisher, 'The Railway Geography of British Malaya', *Scottish Geographical Magazine*, Vol. LXIV, No. 3, 1948, pp.123-36; also *Fifty Years of Railways in the Federated Malay States 1885-1935* (Kuala Lumpur, 1935).
2. A. Wright and T.H. Reid, *The Malay Peninsula* (London, 1912), p.238.
3. The history of the introduction of *Hevea Brasiliensis*, its period of trial in Malaya, and its subsequent phenomenal success has been described in a large number of publications. The following is a select list: O. Marks, 'The Pioneers of Para Rubber Planting in British Malaya', *British Malaya*, Vol. II, No. 10, 1927, pp.281, 285, 292; I.H. Burkhill, *A Dictionary of the Economic Products of the Malay Peninsula, Vol. I.* (London, 1935), pp.1150-52; L.A. Mills, *British Rule in Eastern Asia* (London, 1942), pp.183-214; P.T. Bauer, *The Rubber Industry, a Study in Monopoly and Competition* (London, 1948); and R.O. Jenkins, 'Rubber', *British Malaya*, Vol. XXVI, No. 4, 1951, pp.296-9; and Vol. XXVI, No. 5, 1951, pp.329-37.
4. A. Moore, 'Rubber Growing, Elementary Principles and Practice', in *The Rubber Research Institute of Malaya, Planting Manual No. 7* (Kuala Lumpur, 1938), pp.4-5; also A.T. Edgar (Compiler), *Manual of Rubber Planting (Malaya)* (Kuala Lumpur, 1937), pp.89-90.

3,727,540 acres (or 67 per cent) of the total area of 5,559,150 acres planted to agricultural crops, and accounted for 55 per cent of the total exports valued at $1,600 million.[1]

The results of tin and rubber development on the landscape of Malaya may be summarized briefly.

(1) Physically, it led to the opening up of large expanses of hitherto virgin forest. A country which seventy years previously had only about half a million acres under crops had by 1954 no less than 5.5. million cultivated acres, with 12,492 square miles (or 24.6 per cent) of the total land area of 50,700 square miles under productive and protective forest reserves.

(2) It led the country from economic obscurity to the position of a leading producer of tin and rubber for the international commodity markets. The attendant benefits of prosperity have in their turn permeated into all phases of life in Malaya.

(3) Socially, it resulted in the influx of thousands of immigrants from China, India and Indonesia, and changed Malaya from a racially homogeneous country into a multi-racial country.

(4) The communications system, financed by the revenue from tin and rubber, added a material unifying link to a Peninsula made up of fragmented political units.[2]

It remains now to trace the effects of this development on the traditional Malay economy and on the pattern of population distribution. As indicated earlier, the tin and rubber industries are established along a broad belt in western Malaya, from Kedah in the north to Johore in the south. The bulk of the immigrant population is spread along this belt—in the towns, villages, tin-mines and estates—the Chinese largely in the urban and tin-mining areas, and the Indians dispersed in the rubber estates with two zones of concentration, the Kuala Lumpur to Malacca and the Kinta to Butterworth rubber areas.

The best index of the degree of economic development and the penetration of the money economy into a State in Malaya is the racial composition of its population. The size of the non-indigenous population is also a safe guide to the extent of alien investments, to the intensity of British Administration and degree of control over economic affairs, and the degree to which the earlier subsistence way of life has been influenced by the new economy. The concentration of the immigrant population on the west is illustrated in Table 11. From Penang and Province Wellesley southwards to Johore the immigrant population forms at least a half of the total population of each State. The Malay population is spread along the traditional padi and fishing areas in the north-eastern and north-western States of Kelantan and Trengganu, Kedah and Perlis, and also in the eastern State of Pahang, mainly on coastal locations (Figs. 3 and 4).

1. R.G. Heath, *Annual Report of the Department of Agriculture, Federation of Malaya, 1954* (Kuala Lumpur, 1955), App. 1, p.82; and *Federation of Malaya, Annual Report, 1953*, Table C, p.102.

2. Malaya has never been a political entity. The old Malay sultanates were preserved in much the same form (i.e. shaped round the riverine units) when they came under British protection. The only change in their political structure was in the stabilisation of boundaries. The Peninsula was divided into three major political units—the Straits Settlements of Singapore, Malacca, Penang and Province Wellesley; the Federated Malay States of Perak, Selangor, Negri Sembilan, and Pahang; and the Unfederated Malay States of Kedah, Perlis, Kelantan, Trengganu and Johore. All these States and Settlements, except Singapore, were amalgamated into a federation—the Federation of Malaya—in 1948. The Federation attained its independence on 31st August, 1957.

Malay participation in the economic development of Malaya has been slight. Although Malays had been working tin in historical times, subsequent exploitation of the tin deposits became a monopoly of Chinese and European business interests; the Malays taking part only to a limited extent in the labour and not at all in the capital investment sector.[1] The only significant change in the Malay rural

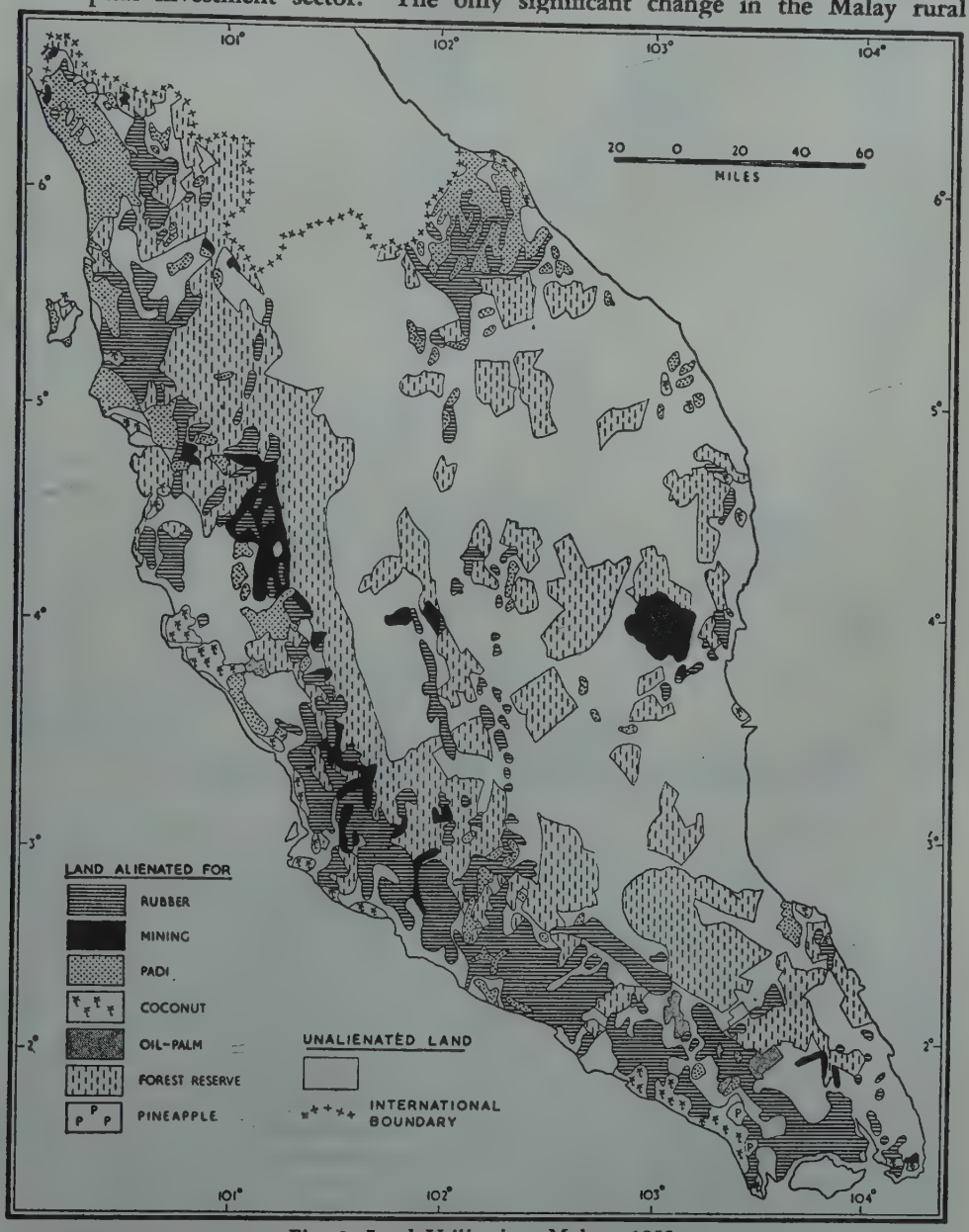

Fig. 3. Land Utilization, Malaya 1953.
Source: *Land Utilization Map* (Survey Department, Federation of Malaya No. 29-1953).

1. There were between 4,000 and 8,000 Malays in the total labour force of 34,000 to 39,000 in the tin-mines between 1950 and 1954, *Federation of Malaya, Annual Report, 1954*, p.32.

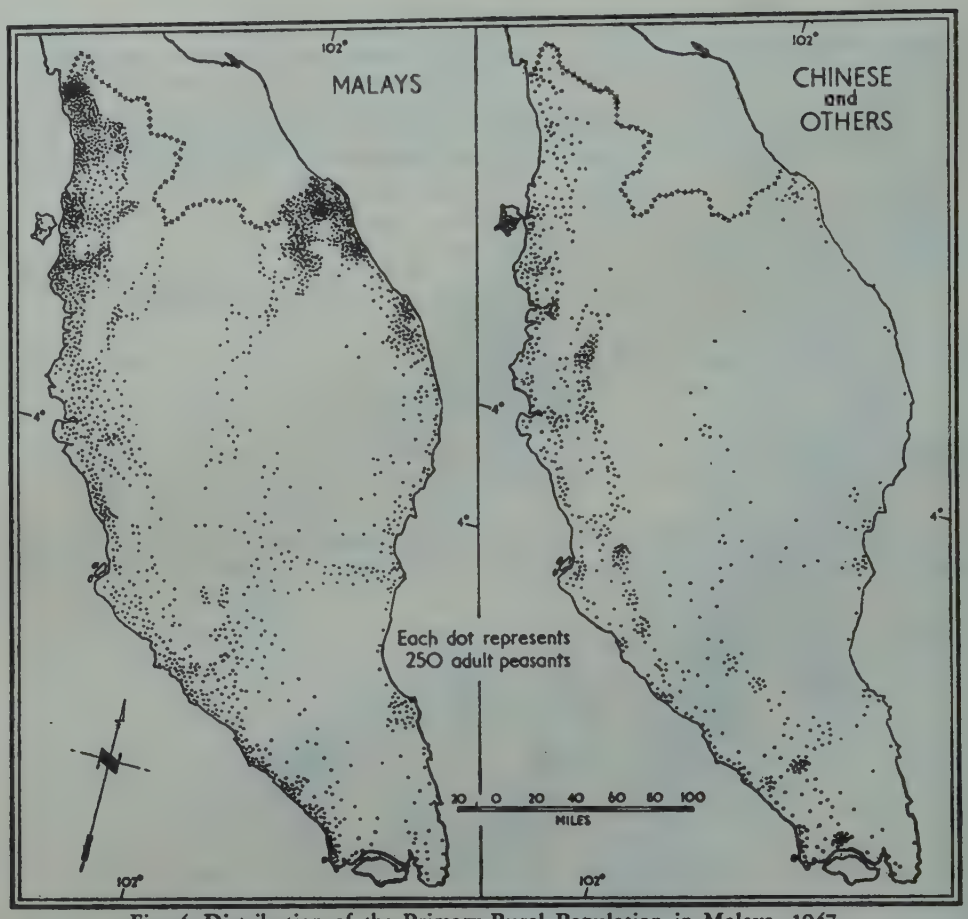

Fig. 4. Distribution of the Primary Rural Population in Malaya, 1947.

economic landscape arose as a result of the increasing extent to which the peasant took to rubber cultivation, introducing the plants tentatively first in his holding mixed with the other tree crops, and later growing them in smallholdings devoted mainly or entirely to rubber. The rubber smallholding is similar in this respect to the cocoa and oil-palm farms of the West African peasant. The rapid spread of rubber cultivation among the Malay peasants was the outcome of three factors. Firstly, the tree fitted easily and naturally into the kampong setting with its emphasis on tree crops. Secondly, its cultivation made little extra demands on the peasant. As the tree is non-seasonal the labour involved in tapping could be spread over the year, and there was no clash in labour needs with the seasonal padi crop. The tree could either be left untapped during the padi sowing and harvest seasons, or the tapping rhythm could be adjusted to meet the situation. There was no necessity for extra draught animals, ploughs or manures, the purchase of which would be beyond the purse of the peasant. The technique of producing rubber sheet from the latex was simple, and required only a little extra investment for the purchase of the tapping knife, coagulant and roller. Thirdly, the peasant soon discovered that in times of good prices an acre or two of rubber could supply his family with the cash necessary to provide a living better than could be obtained from padi-planting, and with less physical effort.

TABLE 11: DISTRIBUTION OF THE POPULATION OF MALAYA

STATE	AREA IN SQUARE MILES	YEAR	TOTAL POPULATION (THOUSANDS)	PERCENTAGE OF TOTAL POPULATION			
				MALAY	CHINESE	INDIANS & PAKISTANIS	ALL OTHERS
PENANG & PROV. WELLESLEY	400	1947	447	29·5	55·4	12·8	1·3
		1954	528	30·0	55·1	13·4	1·5
MALACCA	633	1947	239	50·3	40·2	8·2	1·3
		1954	293	51·0	38·7	8·9	1·4
PERAK	7,890	1947	954	37·8	46·6	14·7	0·9
		1954	1,152	38·0	45·3	15·8	0·9
SELANGOR	3,166	1947	711	26·4	51·0	20·4	2·2
		1954	877	26·7	48·2	21·7	2·4
NEGRI SEMBILAN	2,550	1947	268	41·3	42·8	14·2	1·7
		1954	334	41·6	41·0	15·6	1·8
PAHANG	13,873	1947	250	54·3	38·9	5·9	0·9
		1954	289	53·5	38·5	6·7	1·3
JOHORE	7,321	1947	738	43·8	48·1	7·5	0·6
		1954	905	45·2	45·9	8·1	0·8
KEDAH	3,660	1947	555	68·0	20·9	9·3	1·8
		1954	665	67·4	20·6	10·0	2·0
KELANTAN	5,746	1947	449	92·1	5·1	1·1	1·7
		1954	506	91·5	5·3	1·5	1·7
TRENGGANU	5,050	1947	226	92·0	7·0	0·8	0·2
		1954	257	92·2	6·8	0·8	0·2
PERLIS	310	1947	71	78·3	16·7	2·4	2·6
		1954	83	78·2	16·6	2·4	2·8
TOTAL	50,599	1947	4,908	49·5	38·4	10·8	1·3
		1954	5,889	49·1	37·5	11·8	1·6

Sources: Data for 1947 drawn from del Tufo, op. cit., Table 2, pp. 132-3; data for 1954 from *Federation of Malaya, Annual Report, 1954*, p. 10.

In the deltaic plains of Penang and Province Wellesley, Kedah, Perlis, Kelantan, and Trengganu, padi-growing is a customary occupation inextricably bound up with the peasants' whole way of life. This, together with the fact that the northern and eastern areas have always been isolated from the main stream of economic activities, largely accounts for the little interest shown here by the Malays in rubber cultivation. This does not mean that the crop is not planted in these areas, but only that it is subsidiary to padi as the main crop. There has been little abandonment of padi-fields for rubber in these parts. Rubber was introduced unobtrusively into the Malay kampongs without upsetting the normal pattern of living. Rubber cultivation, when it was taken up on a large scale by the Malays,

tended to draw them away from coastal to interior locations, thus dispersing the Malay population to some extent.

The new roads and railways also exerted an influence on the pattern of peasant settlement. These modern lines of movement were generally laid in a direction following the physical grain of the country, cutting across the traditional lanes associated with the rivers. Passing, in the early days, through new territory, the roads and railways quickly attracted new settlement. Land was cleared on either side and cultivated with rubber, oil-palm or other estate crops, not only by the non-indigenous population, but also by the Malays. Sir Frank Swettenham states that with '... the opening of the country ... the opportunity was quickly seized of putting up small native houses in the middle of a few acres of good land, on the side of a track which was almost certain to become a great highway. Malays, Chinese, and Indians, but especially Malays, were thus induced to take a large interest in the earlier stages of development. A bridle road was no sooner completed than small houses, plantations, and fruit and vegetable gardens sprang up along its whole length.'[1] This ribbon development was but a repetition of the usual form of Malaya settlements, except that instead of being along the coast or along levees, it was along roads and railways. The pattern of settlement and population distribution now assumed a rectilinear, grid-like pattern through the addition of the ribbon settlements at right angles to the rivers and parallel to the Main Range. This dispersal of population was a gradual one and never reached the scale of a mass migrational wave of land occupation as in the case of the immigrant population. Nevertheless, it was considerably quickened through the natural increase of the Malay population resulting from the lowering of the death rate, due to the better health and medical facilities, and also by the influx of Indonesians into the Peninsula. The creation of points of population pressure on land resources arising from the population increase, and local saturation of the land carrying capacity, led in turn to a flow of these riverine people to areas of lower economic pressure. The flow was also augmented in many cases by Indonesian migrants who were not absorbed into the existing Malay areas but founded settlements of their own, while in other cases, the conservative attitudes of the Malays seemed to lead them to withdraw voluntarily from their old villages when these were 'invaded' by the other races for commercial reasons.[2]

The outward flow of the Malay peasant population over the last seventy years has been along two directions. Firstly, there was the flow along the roads and railways manifesting itself in the ribbon settlements already described. Such settlement also occurred along the rivers. River or levee settlement in the earlier days rarely penetrated far inland but with the general growth of population and the establishment of peaceful conditions there has been a gradual advance up-river. This advance is more noticeable in the east coast States along the Sungei Pahang, Sungei Trengganu, and Sungei Kelantan, as well as along the minor rivers. Malay settlements also stretch along almost the length of the Perak River. In many places on the west, however, riverine sites have been rendered valueless by excessive

1. Sir Frank Swettenham, *British Malaya,* p.238.

2. There is no way of estimating the degree of importance of this factor as a cause of population dispersion. According to a Malay, Tunku Yacob bin Sultan Abdul Hamid ('Weekly Fairs in Kedah', *M.A.J.,* Vol. XXII, No. 12, 1934, p.607) the process of dispersion of Malays seems to begin as soon as the village attains sufficient importance to attract other races to start business there. Then, 'the Malays, instead of assisting in the work of betterment ... withdraw to quieter places where they can settle, often having to start afresh by reclaiming new areas of jungle or swamp'. It is likely, however, that more mundane and practical motives, such as population pressure on land, are also involved in the decision to move.

silting of the rivers due to indiscriminate discharge of tailings from the mines and erosion from the rubber estates. Secondly, there was the spread of the peasant population outwards from the linear settlements, both landwards from the coasts and outwards on either side in the case of river, road and railway ribbon settlements. Although the Malay coastal villages have retained their coastal characteristics over the years, there has been a perceptible spread of population towards the interior, this movement being conditioned by the character of the soil and the topography in different parts of Malaya. Malay settlements, once confined to the drier coastal strip between seas and inland swamps on both sides of the Peninsula, have, over the last half-century, advanced landwards into the swamps as pressure of population on the available padi-land increased. This advance has been considerably facilitated by government assistance in swamp clearing, drainage and irrigation, especially on the west where large padi areas have been reclaimed from swampland. Notable amongst these government reclamation schemes are the Krian, the Sungei Manik, the Tanjong Karang, the Kubang Pasu, and the Besut Padi Irrigation Areas. (Fig. 1).

In a manner similar to this landward movement from the coasts is the expansion of ribbon settlements outwards on both sides of the river banks, roads and railways where these passed through swampland suitable for wet-padi cultivation, and through rolling land suitable for rubber. In a hill-and-valley environment, as exemplified in Negri Sembilan, the spread of population from the valley bottom has not only been outwards but has also occurred in an up-stream direction along the valley sides. The extent of this population dispersion here is therefore restricted, and depends on the breadth of the valley floor and the steepness of the slope. In the coastal alluvial plain environment, where flatness is the dominant characteristic, all the large rivers have, in the course of time, built up levees along both banks. The usual site for a Malay settlement is on the levees away from flood risk. Dispersion of population has in this case been towards and into the swampland on either side. In contrast to the hill-and-valley regions, where the outward movement has been up-slope, here it has occurred down-slope along the outside slope of the levees and onto the flat land below.

Both types of landscape present their own peculiar difficulties. In the hill-and-valley areas the scope of the population movement itself has been limited by the steepness of the slopes. There is no terrace cultivation on hill slopes as in Java and the Philippines. In the coastal levee landscape, however, the main problem is excess of water. The water requirements of the padi-plant are greatest during its period of vegetative growth. Tillering and ripening of the grain can only take place if, among other conditions, the fields are free of standing water. In the swamp environment, where heavy rainfall easily leads to floods, the difficulty is usually too much and an inopportune distribution of water, in contrast to the situation in the hill-and-valley regions where local drought may occur due to rapid drainage down the valley sides.

The distribution of the Chinese peasant population is not greatly different from that of the Malays. The main Chinese fishing settlements are situated along the west coast, from Province Wellesley southwards. The Chinese padi-growing population is dispersed throughout the alluvial plain adjoining, or within, the Malay padi areas in all the States, with parts of the Krian Irrigation Area and the whole of the Changkat Jong Irrigation Area standing out as places of relatively greater population concentration. Elsewhere, and especially in those States where the Malay population is numerically superior, the Chinese padi-planters are only of occasional significance in terms of numbers. The same situation obtains as regards Chinese peasant rubber smallholders, the majority of whom are distributed along

the Tin and Rubber Belt in Kedah, Perak, Selangor, Negri Sembilan and Johore. Chinese smallholders are also numerically important in the hinterland of Penang.

The major variation in the distribution pattern of the peasant population introduced through Chinese settlement in Malaya derives from the growth of market-gardening. This highly intensive form of agriculture was brought to the Peninsula from south China. It is based on a closely-knit and interdependent relationship between the growing of short-term crops and vegetables, the rearing of pigs, and the utilization of both pig and human excreta as manure. Table 10 shows that 86,000 of the total working population were engaged in this form of agriculture in 1947.

Market-gardening has long been a part of Chinese agriculture in Malaya. Chinese were mentioned as farmers in Malacca as early as the seventeenth century, and it is probable that some of them were market-gardeners.[1] However, as noted earlier, the Chinese were not interested in food but rather in cash-crops, and the number of market-gardeners did not attain significant proportions until after 1930, when there occurred an awakened interest in growing food-crops, and a noticeable tendency for Chinese to settle down permanently in Malaya. The number of market-gardeners increased from 25,675 in 1921 to 50,910 in 1931.[2] But the number increased rapidly during the Great Depression, when many of the unemployed Chinese turned to growing food, cultivating their plots on the fringes of estates, mining areas, on Government and State land, on Malay Reservations and Forest Reserves. There was a return flow of these squatters from the rural areas to the towns when trade revived. The greatest exodus from the urban areas, mines, estates and other places of employment took place during the Japanese occupation of 1942-45, when thousands of Chinese families returned to the land to grow their own food or to escape from Japanese surveillance, or both.[3] Many of them remained on their farms even after the war was over. These squatters, living in remote and often inaccessible areas, were a source of help to the communist guerillas, and part of the Government campaign against the guerilas included the resettlement of the squatters in new villages, where they could be prevented from helping the communist war effort.

Since the squatters did not take to wet-padi cultivation, because it was a laborious and unrewarding task, the general direction of population movement was away from the wetter sites, and towards the drier locations on the slopes of the hilly areas of the interior. Where the Chinese did migrate to the coastal sites, as in Changkat Jong, they preferred to grow sugar-cane, tobacco and vegetables rather than padi. Other areas of Chinese settlement included Titi and Triang in Negri Sembilan, growing bananas as the main crop; the Grik Valley in Perak, growing padi and tobacco; and the Machap area of north Malacca, growing bananas. Abandoned mining land in Batu Arang and the Kinta Valley was utilized for vegetables and other food-crops, and large patches of rolling land in Johore for food-crops. The total area of land thus opened up for cultivation by the Chinese rural communities was estimated to be 70,000 acres.[4]

1. Purcell, *The Chinese in Malaya,* p.29.
2. J.E. Nathan, *The Census of British Malaya, 1921* (London, 1922), Table 37, pp.289, 294, and 298; and C.A. Vlieland, *British Malaya, A Report on the 1931 Census and on Certain Problems of Vital Statistics* (London, 1932), Tables 126, 134, and 142, pp.269, 294 and 319.
3. Chin Kee Onn, *Malaya Upside-down* (Singapore, 1946), pp.49-51; also *Proceedings of the Federal Legislative Council, February 1948-February 1949* (Kuala Lumpur, 1951), p.C534.
4. *Proceedings of the Federal Legislative Council, February 1948-February 1949,* pp. C534-5.

TABLE 12: DISTRIBUTION OF THE PRIMARY RURAL POPULATION OF MALAYA, 1947

STATE	MALAYS	CHINESE	ALL OTHERS	TOTAL
PENANG & PROV. WELLESLEY	22,295	12,885	583	35,763
MALACCA	13,102	7,172	242	20,516
PERAK	77,769	52,908	2,530	133,207
SELANGOR	31,611	27,365	1,519	60,495
NEGRI SEMBILAN	28,851	9,586	297	38,734
PAHANG	35,613	13,174	219	49,006
JOHORE	51,788	39,976	412	92,176
KEDAH	108,642	11,682	4,200	124,524
KELANTAN	114,002	3,061	2,937	120,000
TRENGGANU	48,159	1,216	75	49,450
PERLIS	23,240	1,963	984	26,187
TOTAL	555,072	180,988	13,998	750,058

Source: del Tufo, op. cit., Tables 103-9, pp. 534-45.

The foregoing discussion on the factors which have influenced the trend and direction of the movements of the primary rural population is intended to be a background against which the map of the distribution of that population in Malaya (Fig. 4) should be viewed. Table 12 shows the number and distribution of the population by States in 1947. The present day distribution would not vary greatly in its general pattern from that shown in Fig. 4. The main changes arise from the resettlement of the Chinese squatter population, who have been moved from their dispersed interior sites into nucleated new villages near the main roads and railways.

CHAPTER II

THE TROPICAL CLIMATE AND RURAL DEVELOPMENT

IT IS A striking fact that 'every modern economically advanced country lies in the temperate zone, though not every country in the temperate zone is economically advanced. A belt around the world at the equator between the Tropic of Cancer and the Tropic of Capricorn contains not a single highly developed country.'[1] Many attempts have been made to explain this fact solely in terms of human attitudes, ideas and institutions, whilst the natural environment of the tropics has been passed over as being of little consequence. In applying the techniques which have proved successful in raising the standards of living in the temperate countries to these underdeveloped areas, the entirely different physical conditions which obtain in the tropics have often been overlookd.

It is evident that the low level of economic advancement of tropical areas cannot be explained satisfactorily without taking into account the part played by the factors of the physical environment. In this and the following two chapters the significance of these physical factors will be appraised.

THE CLIMATE OF THE MALAY PENINSULA

It is proposed to describe the characteristics of the climate of a tropical area—the Malay Peninsula—before considering the tropical climate in relation to rural development.

The Malay Peninsula has a typical equatorial climate, though its insularity and exposure to monsoonal effects result in its climate being slightly different in detail from that of, say, the equatorial areas of the Congo and Amazon Basins. These differences are not so much in temperature as in rainfall, and its annual distribution.

The characteristic features of an equatorial climate are the constantly high annual temperatures and the lack of a cold season. Seasonality in the tropics is a function of rainfall rather than of temperature.

The Malay Peninsula, with its southermost extremity just north of the 1°N latitude and its northern boundary at about 7°N latitude, lies within a zone where the sun's angular elevation above the horizon is high throughout the year. But insularity (no point in the Peninsula is more than 100 miles from the sea), heavy rainfall and heavy cloud cover prevent excessively high temperatures.[2] Altitudinal lowering of the temperature is of little human significance in Malaya where the population is concentrated on the lowlands. Fig. 5 illustrates the monotonous uniformity of the mean monthly temperatures at representative coastal, highland and inland stations. Malacca has a mean annual range of only 1°F, and Kuala Lumpur has a range of 2°F. The east coast stations have a slightly greater range; Kota Bharu has a range of 6°F, and Temerloh, situated inland,

1. E. Staley, *The Future of Underdeveloped Countries* (New York, 1954), p.205.
2. The highest temperature ever recorded in Malaya was 103°F at Pulau Langkawi in March, 1931. The lowest in lowland Malaya was 62°F, recorded at Alor Star in February, 1931. *Malayan Meteorological Service, Summary of Observations, 1936* (Kuala Lumpur, 1937), pp.2, 4.

a range of 4°F. Cameron Highlands, at an elevation of 4,750 feet above sea level, has a range of only 2.4°F.

Daily temperatures show greater variation. The daily range is from 10°F to 15°F at coastal locations (mean maximum of 85°F to 90°F during the day and a mean minimum of 72°F to 75°F at night), and from 15°F to 20°F at inland stations (mean maximum day temperatures of 88°F to 90°F and mean minimum night temperatures of 71°F to 74°F).[1] The strong winds and heavy rainfall, associated with the North-east Monsoon along the eastern parts of Malaya, result in day temperatures a little lower than at corresponding areas in western Malaya during this Monsoon. The cumulative effect of this is shown in the graphs (Fig. 5) for Kota Bharu, on the Kelantan coast, and Temerloh, about seventy miles upstream from the mouth of the Pahang River. Both exhibit a small but distinct drop in mean monthly temperatures during the North-east Monsoon months of November to February.

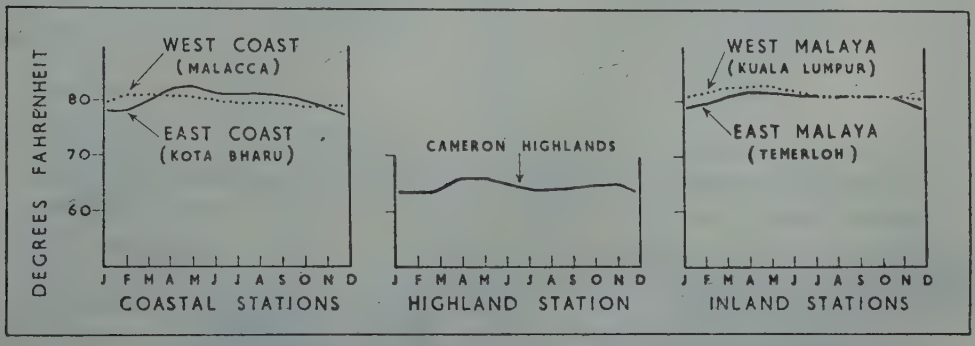

Fig. 5. Mean Monthly Temperatures at Typical Coastal, Highland and Inland Stations in Malaya.

The three main factors influencing the rainfall are:— (1) the Peninsula's maritime exposure, (2) its position in relation to the main air streams of the Indian and the West Pacific Oceans, and (3) the Main Range. The differences in regional rainfall characteristics and in the seasonal variations are due to changes in the main wind currents. From November to February winds from the north-east cross the Malay Peninsula bringing heavy rain to eastern Malaya. From May to August, south-westerly winds bring rainfall to the western regions of the Peninsula. However, two factors modify the character of the rainfall at this season. Firstly, the orographic barrier formed by the high mountains of Sumatra robs the winds of much of their moisture so that they reach Malaya less saturated than the corresponding north-east winds of the North-east Monsoon. Secondly, the South-west Monsoon does not blow across the length of the Peninsula as in the case of the North-east Monsoon, but only across Malaya north of Malacca. South of Malacca the prevailing winds are southerly and bring less rainfall.

The intervals between the monsoons are about eight weeks each. There are no prevailing winds during these intermediate seasons, but daily convectional rainfall is important. The annual rain cycle is thus composed of the two main monsoon seasons with two shorter intermediate seasons. Fig. 6 shows isohyets over the Peninsula for March (intermediate season), June (South-west Monsoon) and December (North-east Monsoon). Table 13 shows the seasonal percentages of annual rainfall received at representative stations. It shows the

1. *Malayan Meteorological Service, Summary of Observations,* for the years 1911 to 1941, and 1947 to 1953.

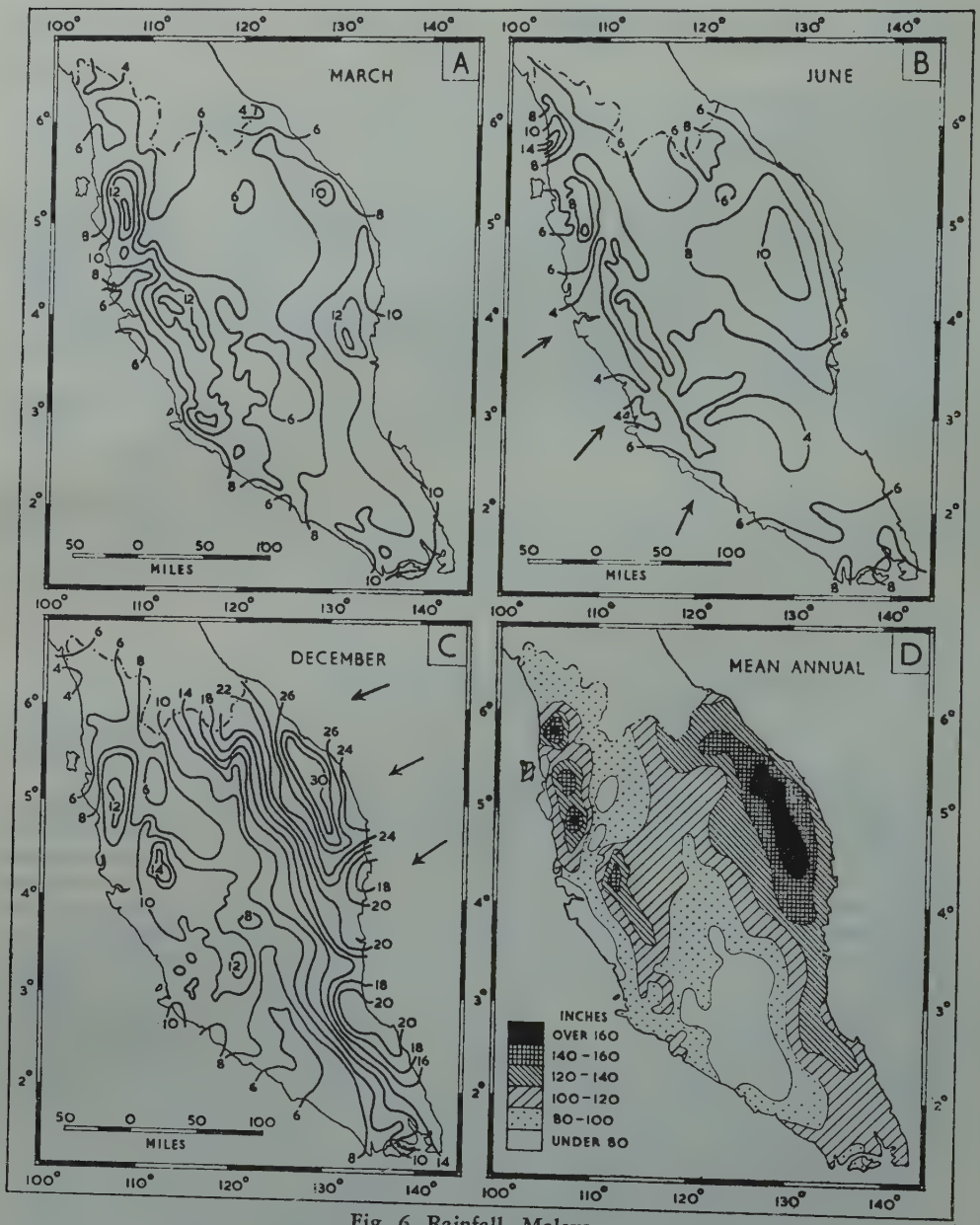

Fig. 6. Rainfall, Malaya.

Source: *Climatological Summaries Part II—Rainfall* (Malayan Meteorological Service, Singapore).

dominating influence of the North-east Monsoon, especially on the east, where nearly half of the total annual rainfall occurs during the four months of this Monsoon. The inland stations too, receive an appreciable amount (one-third) of the annual fall during this season. By comparison, the South-west Monsoon is less important, as illustrated by the fact that along the west coast and at the inland stations (Taiping and Seremban) in the foothill zone the total rainfall received

TABLE 13: SEASONAL DISTRIBUTION OF RAINFALL IN MALAYA

LOCALITY	TOTAL RAINFALL PER ANNUM (IN INCHES)	SEASONAL PERCENTAGE OF ANNUAL RAINFALL			
		NORTH-EAST MONSOON NOV.—FEB.	TRANSITIONAL PERIOD MAR.—APR.	SOUTH-WEST MONSOON MAY—AUG.	TRANSITIONAL PERIOD SEPT.—OCT.
EAST COAST STATIONS					
KOTA BHARU	122	54	9	20	17
KUANTAN	118	52	13	20	15
MERSING	112	50	12	24	14
WEST COAST STATIONS					
ALOR STAR	93	20	15	38	27
PENANG	108	24	12	34	30
MALACCA	87	26	14	38	22
INLAND STATIONS					
TAIPING	166	36	22	22	20
TEMERLOH	81	38	17	25	20
SEREMBAN	91	32	21	28	19

Sources: *Malayan Meteorological Service, Summary of Observations* for the years 1911 to 1941, and 1947 to 1953.

during this season averages 37 per cent and 25 per cent respectively, as compared with the 52 per cent and 38 per cent received by Kuantan and Temerloh during the North-east Monsoon.

The areal distribution of annual rainfall (Fig. 6D) reflects the interplay of the seasonal winds and orography on precipitation. The main differences in regional distribution arise from changes in the major air-streams and from the positional factor relative to the rain inducing barrier of the mountain ranges. These ranges have the strongest relief north of central Malaya and diminish in altitude southwards. They are also set much more towards the west, being about fifty miles at their furthest point from the west coast and more than twice that distance from the east coast. The net effect is that coastal locations on the west are relatively dry, with rainfall increasing landwards due to orographic influence, whilst on the east the reverse is true, and coastal stations here receive heavier rainfall than inland stations (Fig. 7). The distribution over local areas, however, shows wide variations, even over relatively short distances.

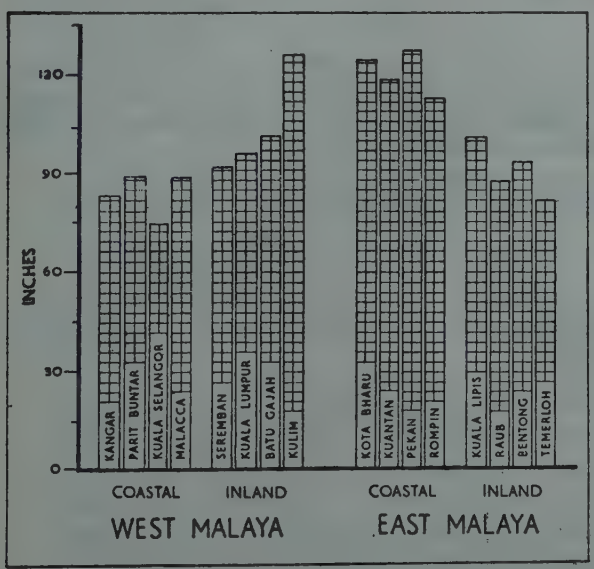

Fig. 7. Annual Rainfall at Selected Stations in Malaya.

As would be expected, the heaviest rains occur on the windward slopes of the Main Range. Maxwell's Hill (4,513 ft.) receives 201 inches annually, and Taiping at the foot of the Hill, 166 inches. Hill stations of approximately the same altitude as Maxwell's Hill, but exposed to winds which have been robbed of much of their rain load when passing over Sumatra, receive considerably less rain—Cameron Highlands (4,750 ft.) has 107 inches, and Fraser's Hill (4,289 ft.) 109 inches annually (Fig. 1). The Jelebu district, on the other hand, is sheltered from both Monsoons, and is consequently the driest area in Malaya with 65 inches per annum.

The daily rain cycle varies with the Monsoons and according to the location of the station (whether coastal, inland, eastern or western). For instance, half the rainfall during the North-east Monsoon at Kuala Lumpur, some 25 miles inland from the Selangor coast, occurs between the hours of two and six in the afternoon, whilst Bukit Jeram, situated on the coast receives its rain spread more evenly throughout the hours of the day. During the South-west Monsoon, however, Bukit Jeram receives about one-quarter of its rain between the hours of two and six in the morning, whilst Kuala Lumpur has a more even distribution, though it still has an afternoon maximum. Records of rainfall occurrence for each hour of each day at Kuala Lumpur have been analysed and the results set down in graph form in Fig. 8. The very low incidence of rain during the morning hours (only 3.5 per cent between 8 a.m. and noon) and the very high incidence during the afternoon and evening (71 per cent between noon and 8 p.m.) are strikingly apparent. Over Malaya most of the rain falls as instability showers during the afternoon and early evening, and the cycle of daily rainfall as shown in Fig. 8 is representative of the inland lowland areas of Malaya.

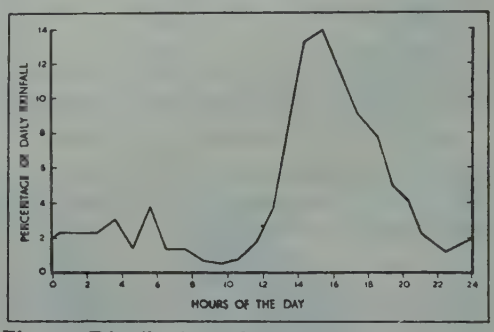

Fig. 8. Distribution of Rainfall according to the Time of Day, at Kuala Lumpur.

High average temperatures and heavy rainfall result in high relative humidity throughout the year, though seasonal variations occur with changes in the Monsoons. Most stations have a relative humidity of 84 or 85 per cent rising to nearly 90 per cent in the highland regions, as shown in Table 14.

TABLE 14: AVERAGE ANNUAL RELATIVE HUMIDITY FOR COASTAL AND INLAND STATIONS IN THE MALAY PENINSULA

COASTAL LOCATIONS		INLAND LOCATIONS	
STATION	AVERAGE RELATIVE HUMIDITY (PERCENTAGE)	STATION	AVERAGE RELATIVE HUMIDITY (PERCENTAGE)
ALOR STAR	84·1	KUALA LUMPUR	83·6
PENANG	83·5	KLUANG	86·6
MALACCA	84·4	KUALA LIPIS	86·8
KOTA BHARU	84·1	TEMERLOH	85·9
KUALA TRENGGANU	85·3	CAMERON HIGHLANDS	89·4
KUALA PAHANG	84·5		
MERSING	86·8		

Sources: As for Table 13.

The daily range of relative humidity is much greater than the monthly range. The daily range is also greater for inland stations than for coastal stations. At inland stations during the night a state of near saturation exists with relative humidities of over 90 per cent, these fall progressively as the morning advances and the temperature rises, and they may drop to between 60 and 70 per cent in the middle of the day and early afternoon, to rise again as evening falls.

Thus uniformly high temperatures and high absolute as well as relative humidities, all combine to give the Peninsula an oppressive climate.

MAN IN A TROPICAL CLIMATE

In attempting to assess the effect of climate on man we meet with a problem of far greater complexity than that of the analysis of climate. Climate has a two-fold effect on man; acting directly on the body (physiological effect); and, considered on a macrocosmic scale, cumulatively on groups of people living in a region experiencing the same climate. But in both cases not only is it necessary to estimate the relative degree of importance of the different components of climate acting both separately and in conjunction, but also to unravel these climatic threads from the skein of other phenomena such as racial characteristics, cultural development, degree of isolation, the effects of diet, disease, changing social tastes and habits. Some of these are only partly dependent upon climate, and others totally divorced from it.

Huntington, supported latterly by Taylor, has endeavoured to show that there is a close relationship between climate and civilization. Working from the basis that every climatic factor can be sufficiently excessive or deficient to destroy any particular organism, and that each particular organism has an optimum climate for its development, he goes on to state that though man can tolerate a wide range of environmental conditions, nevertheless those who live under the most unfavourable climate will be at a disadvantage compared with those who live near the climatic optimum. His main conclusions are that the high level of civilization attained by the western temperate countries has been made possible, to a large extent, by their having climates approaching the optimum, while the low level of civilization in the tropical areas arises from the fact that the climate experienced there is far removed from the optimum.[1] Huntington's theory has been widely challenged,[2] and the general concensus of opinion seems to be that it is not yet possible to draw any concrete conclusion on the relationship between climate and civilization. However, there seems to be some justification for the view that, as far as the humid tropics are concerned, the climate is not helpful to human advancement.

Physical Energy and Work in a Tropical Climate. Biologists assert that since for all other forms of life there are certain conditions which produce the finest stocks or species, so also for man there must be certain conditions of diet

1. E. Huntington, *Civilization and Climate* (New Haven, 1924); 'The Effect of Climate and Weather', in E.V. Cowdry (ed.), *Human Biology and Racial Welfare* (New York, 1930) pp.295-330; and *Mainsprings of Civilization* (New York, 1945). Also G. Taylor, *Our Evolving Civilization* (Oxford, 1946).
2. See for example, R.B. Dixon, *The Building of Cultures* (New York, 1928), pp.20-1; P. Sorokin, *Contemporary Sociological Theories* (New York, 1928), pp.137-59, 186-93; Sir R.W. Cilento, 'The White Man in the Tropics', *Commonwealth of Australia, Department of Health,* Service Publication (Tropical Division), No. 7, 1925, pp.59-75; and 'Rejoinder to Professor Huntington', *Economic Record,* Vol. VI, No. 10, 1930, pp.127-32; C.H. Wickens, 'Dr. Huntington and Low Latitudes', *Economic Record,* Vol. VI, No. 10, 1930, pp.123-7; and 'Vitality of White Races in Low Latitudes', *Economic Record,* Vol. III, No. 4, 1927, pp.117-26.

and climate which produce the most efficient and energetic human beings. These conditions combine to form the 'ideal' or 'optimum' climate.

Huntington has attempted to show the correlation between human energy and the various climatic elements of temperature, sunlight, humidity, winds and storms. His conception of the 'ideal' climate is an average temperature of about 64°F for day and night, and a relative humidity of about 80 per cent. With the rise in temperature the mid-day relative humidity falls to about 60 per cent. The mid-day temperature should be about 70°F. The optimum climate for physical work is one in which the mean temperature never falls below 38°F or rises above 60°F, or possibly 65°F. Also important are changes in conditions from day to day. These prevent monotony and provide stimulation.[1] Huntington considers the uniformity of climate in the tropics to be more deadly than its heat. 'Such uniformity, perhaps as much as the high temperature and high humidity, may be one of the most potent causes of the physical debility which affects so many white men within the tropics.'[2] The tropical lowlands are thus considered to be very low energy areas.[3]

Taylor has worked out a 'comfort' and 'discomfort' scale in which he places the ideal climate at wet-bulb temperatures of between 44°F to 55°F when the humidity is between 70 to 80 per cent.[4]

Stone has carried out a series of experiments to discover the 'comfort zones' of the tropics. His findings, based on experiments at Batavia (latitude about 6°S), suggest that the lower limits of comfortably cool temperatures are; for dry-bulb, 69°F to 74°F; and for wet-bulb, 56°F to 67°F. Below this range, it is too cool for comfort. The upper limits of comfortably warm temperatures are; for dry-bulb, 75°F to 86°F; and for wet-bulb, 64°F to 76°F. Above this range it is too hot for comfort. Hence the comfort zones lie between dry-bulb temperatures of 69°F and 86°F, and wet-bulb temperatures of 56°F and 76°F.[5]

On the basis of these conclusions it is evident that the uniformly hot and humid climate of the wet tropics is far from the ideal for comfort and human energy. To relate these findings to conditions in the Malay Peninsula, Fig. 9 shows the mean monthly temperature and relative humidity at three localities (two coastal and one inland) in Malaya plotted against those of the optimum climate. As can be seen, the average temperature and relative humidity at these representative stations do not approach anywhere near the optimum, on the contrary, all of them show

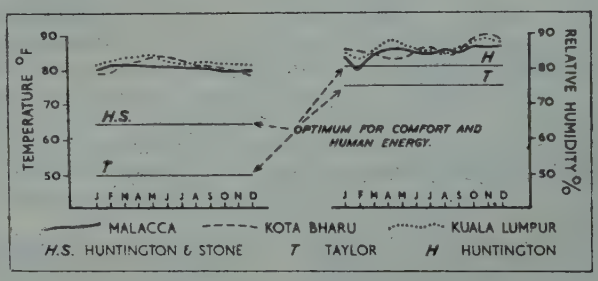

Fig. 9. Mean Monthly Temperature and Relative Humidity at Malacca, Kuala Lumpur and Kota Bharu, as Compared with those of the 'Optimum Climate'.

1. The most desirable climate is one which shows moderate variations in temperature from day to day, particularly falls in temperature such as are associated with storms. E. Huntington, *World Power and Evolution* (New Haven, 1919) pp.58-86.
2. Huntington, *Civilization and Climate*, p.227.
3. Ibid., Fig. 43, p.295; also Huntington, 'The Effect of Climate and Weather', Fig. 8, p.322.
4. G. Taylor, 'The Control of Settlement by Humidity and Temperature', *Commonwealth of Australia, Bureau of Meteorology, Bulletin No. 14*, (Melbourne, 1916), pp.16-22.
5. R.G. Stone, 'Comfort Zones and Acclimatization' in A.G. Price (ed.), *White Settlers in the Tropics* (New York, 1939), App. II, pp.284-7.

uniformly monotonous temperatures and relative humidities of around 80°F and 85 per cent respectively. These conditions are far from the ideal for human health and physical work.[1]

TABLE 15: AVERAGE TEMPERATURES AT DIFFERENT LATITUDES, AS COMPARED WITH THE OPTIMUM FOR PHYSICAL ENERGY AND COMFORT

LATITUDE	TEMPERATURE °F			
	HOTTEST MONTH	COLDEST MONTH	MEAN ANNUAL	UPPER LIMIT OF OPTIMUM
EQUATOR	80	79	79	76
10°N	80	79	80	76
20°N	82	71	79	76
30°N	81	60	68	76
40°N	75	41	59	76

Source: J. von Hahn, *Lehrbuch der Meteorologie* (Leipzig, 1908-11), Vol. II, p. 7.

In the Northern Hemisphere, temperatures do not begin to approach the optimum until latitudes of between 20° and 30°N. are reached, as Table 15 illustrates. It seems clear that the peoples of the tropics are at a disadvantage, as compared with those in higher latitudes, because they have to work under climatic conditions far removed from the optimum. Also, as the mode of living in the tropics is founded on agriculture, fishing and other outdoor physical activities, this may be a factor of some magnitude. The final conclusion reached by Stone was '.... that man was not made for hot climates, however adequate the temporary defences against heat may be.'[2]

Climate and Work in Malaya. The daily work cycle of the peasant smallholder depends on the nature of his occupation. The main occupation of the large majority of the peasants in Malaya is padi cultivation. This involves hard physical labour for twenty-five to thirty-five days a year, during which time the peasant and his family may start work early in the morning, continue until about 11.30 a.m. and resume work after the period of fiercest heat (from noon to about 3 p.m.) has passed. When there is late planting or, as happens in east Malaya, when the harvest has to be gathered in before the Monsoon arrives, work may continue until dusk. But this period of hard work occurs only at the beginning (ploughing and transplanting) and end (harvesting) of the padi season. During the period when the plants are growing, the normal routine work consists of weeding (which is performed most often in the early morning), and fishing in the flooded fields.

The peasant rubber smallholder, in contrast to the padi farmer, has an economy based on a perennial crop. His work cycle therefore shows little variation throughout the year. The normal daily routine is for the smallholder to tap his trees (with the help of his wife if he owns a large acreage) at about six or earlier in the morning. This task is usually completed by nine o'clock. The task of coagulating the latex and rolling it into sheets takes a shorter time, and the day's work is usually completed by noon. The average time taken per man to

1. See also C.E.A. Winslow and L.P. Herrington, *Temperature and Human Life* (Princeton, 1949), pp.186-93.
2. R.G. Stone, 'Some Results of Modern Physiological Research in Relation to Acclimatization in the Tropics', in Price (ed.) *White Settlers in the Tropics*, App. I, p.283.

tap 390 trees is 3½ hours. The average number of tapping days per month is twenty.[1]

The smallholder therefore has most of the afternoon free. A part of it may be taken up with transporting the prepared rubber to the nearest dealer, and he may also spend some time in other miscellaneous occupations such as coconut picking or fishing. Often, however, he does nothing at all for the rest of the day.

The most striking feature of the daily rhythm of peasant work in Malaya is the virtual cessation of outdoor activity during the hottest part of the afternoon. Apart from exceptional occasions, such as padi harvesting, most of the heavy physical outdoor work is done in the cool of the morning, and sometimes again in the early evening. This practice is not peculiar to Malaya, but is also common in other tropical areas. In many parts of tropical Africa, for instance, the day's work begins at five in the morning and ends before noon.[2] In Santubong, a Malay village on the north-western coast of Sarawak, the early morning and late afternoon are the usual periods for outdoor activity. The hot afternoon, in Sarawak as in Malaya, is spent either in the cool of the house or in the shade of the kampong around the house, but seldom out in the sun.

TABLE 16: HOURS OF PHYSICAL LABOUR PER DAY AMONG PEASANTS IN MALAYA, 1949

WORK GROUP	NATURE OF WORK (RECORDED IN HOURS PER DAY)							
	HEAVY		MODERATE		LIGHT		TOTAL	
	(A)	(B)	(A)	(B)	(A)	(B)	(A)	(B)
PEASANT AGRICULTURISTS	1·3	1·3	1·2	1·2	0·8	0·8	3·3	3·3
PEASANT FISHERMEN	4·3	3·2	0·3	0·3	0·5	0·5	5·1	4·0

Source: (A) *Federation of Malaya, Annual Report of the I.M.R., 1949* (Kuala Lumpur, 1950), p. 46.
(B) R.C. Burgess and Laidin B. Alang Musa, 'A Report on the State of Health, the Diet and Economic Condition of Groups of People in the Lower Income Levels in Malaya', *I.M.R., Report No. 13* (Kuala Lumpur, 1950), Table XV, p. 34.

Surveys have been carried out by the Institute for Medical Research in Malaya of the actual hours of work performed per day by peasant smallholders and fishermen. The results are summarized in Table 16. A normal working day varies from 3.3 to 5.1 hours. These are extremely short hours of work according to western standards. In point of fact, not only is the working day short, but on a number of days per month no work is done at all. A survey of a group of fishermen revealed that the individual fisherman went to sea on an average of only twenty days a month.[3]

The peasant in other parts of the tropical world seems to have much the same rhythm of work. An enquiry on 700 to 800 agricultural peasants in the West Indies showed that the individual labourer worked for an average of five hours a day on four days per week, or sixteen days a month of four weeks.[4] The Bembas of Northern Rhodesia work for five to six months in an agricultural year, averaging about four hours a day.[5]

1. H.D. Meads, 'Bark Consumption and Bark Reserves on Small Rubber Holdings in Malaya', *Department of Agriculture, Economic Series No. 4* (Kuala Lumpur, 1933), pp. 18, 44-5.
2. *Observer*, 7th January, 1951.
3. *Federation of Malaya, Annual Report of the I.M.R. 1949* (Kuala Lumpur, 1950), p.46.
4. E.A. Seagar, 'Labour Efficiency', *Tropical Agriculture*, Vol. VII, No. 2, 1930, p.44.
5. A.I. Richards, *Land, Labour and Diet in Northern Rhodesia* (Oxford, 1939), pp.394-7.

It is very difficult, if not impossible, to elucidate the nature of the relationship between the climatic components of the environment and the number of hours of work performed by the peasants in a day, as the whole question is intricately bound up with other factors. The one phenomenon that might be cited as a casual link between climate and peasant is the observed reluctance on his part to expose himself to the direct rays of the mid-afternoon sun, which leads to a loss of three to four hours during which little or no productive work is done. All other links are indirect ones, and with every increase in indirectness there is a parallel increase in the number of other factors which may also be responsible for the result, so that the precise share of the climate in the final outcome becomes untraceable.

Among the other important material causes, the poor physique of the peasant has been cited as a contributory factor for his observing a short working day. The Report of the Malayan Delegation to the League of Nations' Inter-Governmental Conference on Rural Hygiene drew attention to the low stamina of the poorer classes. More individuals were required to perform a given physical task in a set time than in Eurpe.[1] A medical examination of Asian labourers showed that the average weight of a Chinese doing normal muscular work was 122 lb. and that of a Tamil 101 lb., as compared with the equivalent weight of 160 lb. of a European labourer.[2] The climate was mentioned as an important cause for the failure of the Asian labourers to do heavy work over sustained periods. It was also evident that the lessened energy, and lowered resistance to infection due to defective or deficient diets, must be taken into account. This question will be discussed later in Chapters III and IX.

Several qualifications have to be made with regard to the enervating effects of the tropical climate. Firstly, in a marine-equatorial country such as Malaya, the heat and humidity are tempered to some extent by local breezes and especially by the land and sea breezes along the coasts. However, these latter breezes are felt only for a distance of about ten miles from the shore, and inland areas, such as the Kinta Valley, Kuala Lumpur district, and the hill-and-valley landscape of Negri Sembilan, have no constant source of wind relief. Also, throughout the Peninsula houses sited on higher ground are able to take advantage of any available breeze.[3] But the houses of neither the Malay nor the Chinese peasants are so placed. The typical Malay house is usually sited in a kampong beneath a dense tree cover. Relief from the heat in this case comes from the shade and not from breezes. The close canopy of leaves in a rubber holding provides a cool working location, but padi cultivation in bare, flooded fields means exposure to the direct rays of the sun, the intensity of which is doubled by reflection from the water. The relative humidity here is near to saturation point. Secondly, not enough is known as yet about the processes of acclimatization of the permanent inhabitants of the tropics. These processes have been defined as 'those functional changes that occur within the individual with continued or repeated exposures to the climate.'[4] Because of this state of uncertainty and relative ignorance, it is difficult to assess the possible causes of what has been termed 'the instinctive conservation of energy . . . . . in tropical races.'[5] How far

1. League of Nations, *Report of the Inter-Governmental Conference of Far-Eastern Countries on Rural Hygiene, Bandoeng, 1937* (Geneva, 1937), pp.26-7.
2. J.A. Campbell, 'Diet, Nutrition and Excretion of the Asiatic Races in Singapore', *J.S.B.R.A.S.*, No. 79, 1918, Table II, p.112.
3. J.A. Campbell, 'Body Temperature and Comfort', *J.S.B.R.A.S.*, No. 80, 1919, pp.63-6.
4. E.F. Adolph and associates, *Physiology of Man in the Desert* (New York, 1947), p.329.
5. Seagar, op. cit., p.43. Even those who appear to be acclimatized to tropical conditions show a disinclination for work, which tends to reduce output. D.H.K. Lee, *Climate and Economic Development in the Tropics* (New York, 1957), p.99.

this is due to the adaptation of the human body to the tropical climate is a matter of conjecture, but it certainly demonstrates the dangers of a summary branding of the inertness of the peasant as being due to his 'laziness'. Dill and Edwards have stated that 'the leisurely habits of those who live in the tropics have a sound basis in physiological necessity.'[1] Brunt has stated that 'it cannot be said that the coloured races have in reality become acclimatized to tropical climates, even after many centuries.'[2]

The preceding examination of climate and the rural population in the tropics has demonstrated two points. Firstly, that climate and weather in the tropics are far from the optimum for physical labour. Secondly, that the actual number of hours of productive work and the number of days in the month which the peasant spends on such work are both very small. The relationship between the two cannot be accurately ascertained, but the practical consequences and implications are more easily discernible. The fact that climatic conditions in the hot wet tropics are far from the climatic optimum for physical labour may not, in itself, be of great significance. But it must be borne in mind that peasant production in the tropics is based largely on agriculture and similar activities which must be done by human labour out-of-doors. Taking into account the poor diet, the low stamina and the short working hours, the climatic element thus seen in perspective may be regarded as a serious obstacle to rural development.

OTHER CLIMATIC PHENOMENA AS HANDICAPS TO RURAL DEVELOPMENT.

Whilst the effect of climate on man is not very tangible, its effect on the environment in which man lives is more direct. The effects of some climatic phenomena, such as wind storms, floods and other rainfall conditions, on peasant activities and on the economic landscape in the tropics will be briefly considered here.

Wind Storms. The violent tropical winds that bring in their wake high storm-waves, heavy condensation and torrential precipitation are known by different names. They are known in the Indian Ocean as 'cyclones', in the Philippines as 'baguio', in the South Seas and the North Atlantic as 'hurricanes', and in the North Pacific, the China Sea and Japan as 'typhoon.'[3] Though these tropical storms do not occur as frequently as the extra-tropical cyclones, they are far more destructive than the latter. It has been calculated that about forty hurricane-producing storms are generated in the tropics in an average year, with twice as many gale-producing storms. An average of about five violent storms occur each year in the West Indian area, five off the west coast of Mexico and Central America, six in the central North Pacific, twenty-five in the eastern North Pacific, thirteen in Australia, fifteen in the South Pacific, twelve in the South Indian Ocean and twelve in the North Indian Ocean.[4] Areas lying in the path of these storms almost always suffer great damage, not only from winds of gale force and from intense rainfall, but also from the tidal waves and floods following in their wake.

1. Quoted by Price, *White Settlers in the Tropics,* p.216.
2. D. Brunt, 'The Reaction of the Human Body to the Physical Environment', *Qrtly. Jrn. Roy. Met. Soc.,* Vol. LXIX, No. 300, 1943, p.111.
3. For a description and account of typhoons in the Pacific area, see *Weather in the China Seas and in the Western Part of the North Pacific Ocean, Vol. I* (London, 1937).
4. S.S. Visher, 'Rainfall and Wind Conditions Retarding Tropical Development,' *Economic Geography,* Vol. VI, 1930, pp.160-5.

Tropical cyclones do not occur between latitudes 5°N and 5°S. The Malay Peninsula lies almost entirely within this zone. Of the typhoons that originate in the South China Sea, only five, in thirty-eight years, have crossed the Peninsula, and none occurred south of latitude 5°N. Most typhoons pass well to the north of the 10°N latitude.[1] The last recorded storm of typhoon force over Malaya occurred in 1883 when the north-east coast (Kelantan and Trengganu) was affected. It was as destructive as any hurricane in the West Indies, and nearly all the forest trees in its path were destroyed.[2] But it was an exceptional occurrence, and the normal Malayan year is free from such storms. However, thunderstorm squalls, known locally as 'sumatras', occur periodically between April and November along 200 miles or more of the west coast of the Peninsula, and these are often violent enough to do great damage to shipping, towns, buildings and cultivated areas lying in their path.[3] They may reach a wind force of 8 (Beaufort Scale) and may last up to two hours, but they rarely penetrate more than twenty-five miles inland. They occur with greatest frequency along the stretch of coast from Singapore to Port Swettenham. North of Port Swettenham they are rarely of great violence.[4]

Although the 'sumatras' are capable of causing extensive damage, they are of lesser human significance in Malaya than the North-east Monsoon. The Monsoon affects the entire stretch of the east coast, and its influence on human activities is much more widespread because it continues almost uninterruptedly for one-third of the year, that is from November to February. The strong winds, heavy rainfall and rough seas reduce outdoor peasant activities to a low level. Shipping is seriously affected since most of the vessels are small and unable to withstand the rough conditions. Fishermen are forced to do close inshore fishing, only venturing out to sea during occasional lulls. Padi crops are often destroyed by the floods. The impact of the Monsoon is all the greater because most of the peasant settlements are located along coastal and deltaic areas exposed to its full force. Even rubber tapping, normally a year-round activity elsewhere in the Peninsula, is curtailed because of heavy rain in the mornings (when tapping is usually done) or because overnight rain or floods render work impossible. Smallholder rubber is normally of poor quality and the constant overcast skies and damp conditions result in a further deterioration of rubber quality.

Floods. In low-lying and deltaic areas floods are common throughout the Peninsula. Wide and shallow rivers meandering across a flat coastal plain often overflow during a short spell of intense rainfall in the upper reaches, or, as in eastern Malaya, after the heavy seasonal downpour during the Monsoon.[5] The state of the larger rivers deteriorated rapidly with the opening up of the country. The deforestation of large stretches of jungle, often on steep slopes, as in the Kinta Valley, for both mining and agriculture, and the clean-weeding of rubber estates practised during the earlier phases of the rubber industry, led to the removal of immense quantities of top-soil, silt and other eroded material into

1. *Weather in the China Seas,* Vol. II, pp.77-8; also Dobby, *Southeast Asia,* pp.40-3.
2. F.G. Browne, 'Storm Forest in Kelantan', *The Malayan Forester* Vol. XII, 1949, pp.28-33.
3. H.B.F. Moorhead, *Malayan Meteorological Service, Summary of Observations, 1940* (Kuala Lumpur, 1941), p.10.
4. I.E.M. Watts, 'Line-Squalls of Malaya', *M.J.T.G.,* Vol. 3, 1954, pp.10-11.
5. P. McNee, *Federation of Malaya, Report of the D.I.D. for the year 1952, 1953 and 1954* (Kuala Lumpur, 1955), pp.21-3.

the rivers and raised the levels of the channel beds considerably.[1] In the Pahang Delta, for example, floods now occur annually, though the older peasants living there remember the time when floods were only of occasional incidence and the Pahang River bed was very much deeper than it is now. Sometimes, as in 1926, 1947 and 1954, there are Peninsula-wide floods which may paralyse normal work for days and even for weeks at a time.[2]

Rainfall Variability and Tropical Agriculture. In the wet equatorial tropics lack of water is not normally a problem. Dry spells, lasting for three or four weeks may occur in Malaya, but they are only of occasional incidence and do not greatly affect perennial crops such as rubber and oil-palm. But away from the equatorial belt, in the monsoon regions and the sub-tropical regions bordering the hot deserts, both the amount and incidence of rainfall are of critical importance to agriculture. Large parts of tropical Africa and South America are subject to inadequate and uncertain rainfall, due partly to their continentality and partly to local physical configuration. In the South-east Asian tropics it is the incidence rather than the amount of rainfall that is critical to peasant agriculture, especially in the eastern half of Java, parts of Celebes and the Philippines, and the continental areas with monsoonal rainfall such as the Dry Zone of Burma and the Korat Plateau of Thailand.[3]

Seasonal variation of rainfall is a great handicap to agriculture in the tropics. Table 17 shows that the 5.66 million square miles of land in the world which are between latitudes 30° and 60° North and South have a percentage range of mean monthly rainfall of above 20 per cent over only one-third of their area, whereas the tropical lands (15.77 million square miles) with nearly three times the area of the temperate lands have more than half their total area (59 per cent) with a rainfall variability of above 20 per cent.[4]

Not only is the rainfall more variable in tropical areas from season to season, but it is also erratically distributed, particularly in the semi-arid and arid regions, such as Egypt, the Sudan, much of South Africa and North East Brazil. The unreliability of rainfall from year to year and from region to region means that there is great difficulty in fitting crop to rainfall type. The areas which are best adapted to a particular crop variety are therefore small and widely scattered, thus rendering planning for agricultural development a complicated task. Within the tropics the equatorial belt has the most reliable rainfall, though its distribution may vary noticeably because of situation in relation to prevailing winds and local conditions.

Tropical Rainfall and Soil Erosion. Both excessive falls within short periods, and the forceful impact of such rainfall upon the soil in the tropics are conducive to rapid run-off and soil erosion. Much of the precipitation in the tropics occurs as thunderstorms, when high intensities of fall are recorded, whereas in the temperate latitudes a larger percentage of the precipitation occurs as gentle

1. *Report on Rivers in the Federated Malay States* (Kuala Lumpur, 1928); also Sir Lewis Fermor, op. cit., pp.152-4, 161-9; and Sir George Maxwell, 'River Control in the Federated Malay States', *British Malaya,* Vol. III, No. 3, 1928, pp.77-9.
2. The most destructive flood in Malaya occurred in 1926 when river levels rose from sixty to eighty feet above normal. For accounts of this flood, see 'The Floods in Malaya', *British Malaya,* Vol. I, No. 11, 1926, pp.303-9; and R.O. Winstedt, 'The Great Flood, 1926', *J.M.B.R.A.S.,* Vol. V, Pt. II, 1927, pp.295-309.
3. R.L. Pendleton, 'Land-Use in North-Eastern Thailand', *Geographical Review,* Vol. XXXIII, No. 1, 1941, pp. 15-41.
4. For further details on rainfall variability in the tropics, see R.P. Beckinsale, 'The Nature of Tropical Rainfall', *Tropical Agriculture,* Vol. XXXIV, No. 2, 1957, pp.89-92.

TABLE 17: PERCENTAGE RANGE OF MEAN MONTHLY RAINFALL ACCORDING TO LATITUDE

CONTINENT	RANGE 20—30 PER CENT		RANGE OVER 30 PER CENT	
	MILLION SQ. MLS.	PERCENTAGE	MILLION SQ. MLS.	PERCENTAGE
TROPICAL AREAS (LATS. 0—30°)				
N. AMERICA	0·70	61	0	0
S. AMERICA	1·31	21	0·04	1
ASIA	2·56	60	0·63	15
AFRICA	8·86	78	0·21	2
AUSTRALIA	1·32	59	0·13	6
WEST INDIES	0·01	1	0	0
TOTAL	14·76	—	1·01	—
TEMPERATE AREAS (LATS. 30—60°)				
EUROPE	0·03	1	0	0
N. AMERICA	0·14	3	0	0
S. AMERICA	0·13	14	0	0
ASIA	3·75	49	1·13	14
AFRICA	0·47	41	0	0
AUSTRALIA	0·005	0·6	0	0
TOTAL	4·53	—	1·13	—

Source: S. S. Visher, 'Rainfall Conditions as Handicaps to Tropical Development, with special mention of Australia and the Pacific', *Geographical Review*, Vol. XV, No. 3, 1925, Tables I and II, p. 459.

rain spread over a longer period of time so that there is less erosion and less leaching, and a better chance for absorption by plants.[1]

In Malaya it has been calculated that for an average open soil the maximum absorptive rate is about three inches of water per hour. In very sandy soils the rate may be twice this figure, but most Malayan soils have a rate of less than three inches. While much of the precipitation occurs as short intense showers, steady continuous rainfall over long periods has much the same erosive effect because the soil has little chance to dry out between falls. In Johore Bahru in February 1925, for example, heavy rain fell almost without ceasing for nearly a week. This, however, is exceptional, and the normal pattern is one of heavy falls for short periods. Local downpours may occasionally reach intensities of six inches or more per hour. Records kept at Kuala Lumpur of the maximum intensity of rainfall reached in each of 581 consecutive showers, show that 154 showers (26.5 per cent) fell at a maximum intensity exceeding three inches per hour (Fig. 10). In effect this meant that an average of one in four showers fell with an intensity greater than the absorptive rate for an average open soil, with corresponding erosive effect.

1. S.S. Visher, 'Rainfall Conditions as Handicaps to Tropical Development, with special mention of Australia and the Pacific', *Geographical Review*, Vol. XV, No. 3, 1925, Tables I and II, pp.463-4, also Beckinsale, op. cit., p.89.

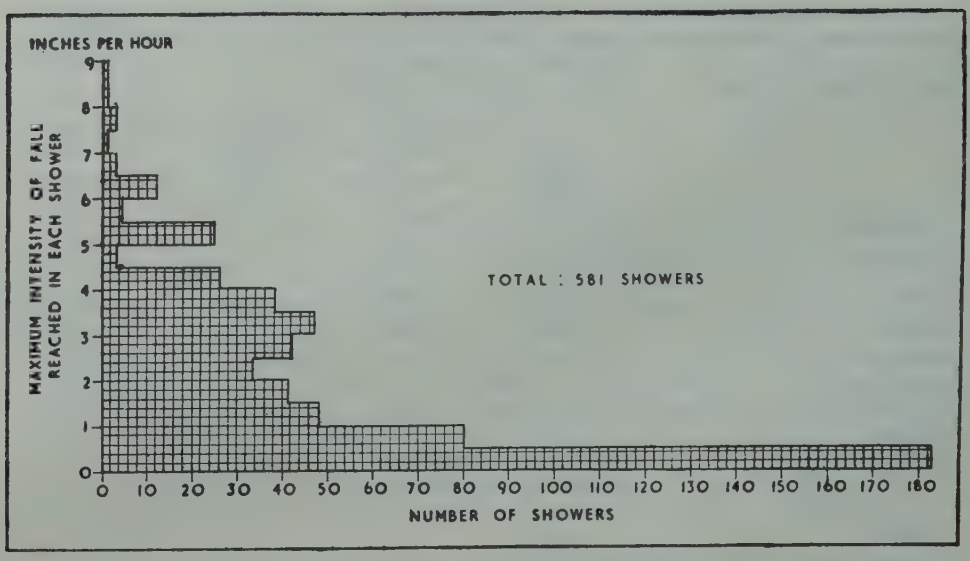

Fig. 10. Rainfall Intensity at Kuala Lumpur.

Source: W. B. Haines, 'Summary of Meteorological Records, Soils Division' *Rubber Research Institute of Malaya, Bulletin 4* (Kuala Lumpur, 1931), Fig. 4, p.11.

The need for keeping the soil covered is clear. In heavy forest the thick vegetation absorbs the heaviest impact of the raindrops, but wherever the forest is felled, especially on hill slopes, its protective function is lost. The amount of top-soil which will be removed by subsequent water erosion depends on three factors: (1) the interval between the time of exposure of the soil and the establishment of a new protective cover, (2) the type of crop planted (in general perennial tree crops with thick foliage, such as rubber, are better for soil conservation than annuals such as tapioca, hill padi, and maize), (3) the slope of the land. For example, in Ceylon it was found that rubber plantations on a 30° slope and without the additional protection of ground cover-crops lost an average of seventeen tons of top soil per acre per annum.[1] In Malaya soil experts have estimated that at least three inches of top-soil have been lost on rubber estates which were clean-weeded. This is equivalent to about 330 tons per acre per annum.[2] The significance of this loss is apparent when it is realized that Malayan soils have, with few exceptions, a very low content of organic matter and humus, and that this organic matter is mainly concentrated in the top few inches.[3]

The extent of soil erosion is also influenced by the system of agriculture practiced. In lowland Monsoon Asia and the Malay Peninsula, where the basis of peasant agriculture is wet-padi cultivation, erosion is negligible. Soil deterioration and erosion here are due mainly to the cultivation of dry annual crops. But in, say, the African tropics where the mainstay of native agriculture is some form of shifting cultivation based on annual food crops, soil erosion becomes a major

1. Edgar, op. cit., p.24.
2. Fermor, op. cit., pp.153-4.
3. G. Owen, 'A Provisional Classification of Malayan Soils' *Journal of Soil Science*, Vol. II, No. 1, 1951, pp.29-30; also R.G.H. Wilshaw, 'Studies in Malayan Soils', *M.A.J.*, Vol. XXII, No. 1, 1934, pp.22-3.

problem. Jacks looks upon soil erosion in Africa as 'an almost insuperable obstacle to development,' and upon shifting cultivation as the principal cause of this erosion.[1] Compared with the temperate countries the tropical areas are more affected by soil erosion.[2]

To sum up, the tropical peasant lives in a climate which, compared with that of temperate regions, is unfavourable to physical effort. At the same time he is exposed to the hazards of wind-storms and floods, and of variable rainfall which adversely affects his agricultural production. His land is also more liable to be seriously eroded by the intensity of the tropical rainfall. All these factors, acting cumulatively and in conjunction with such factors as disease and malnutrition, account in part for his low material standards of living. Rural development in the tropics, which aims at raising these standards of living, must perforce involve the expenditure of greater efforts than would be required in the temperate zone because of the existence of these natural handicaps, which are either absent or of less consequence in the latter zone.

1. G.V. Jacks and R.O. Whyte, *The Rape of the Earth* (London, 1947), pp.247-9.
2. M. Guillaume 'Organization of Soil Conservation in the Intertropical Zone of the French Union', *African Soils*, Vol. I, No. 1, 1951, p.23.

CHAPTER III

DISEASE IN A TROPICAL ENVIRONMENT

IN THIS chapter the biogeographical aspects of rural development in the tropics will be considered.

CLIMATE AND DISEASE

Medical geography is defined by May as 'the study of the relationships between the pathological complex (pathogens), and the geographic factors (geogens) which determine its evolution and behaviour.'[1] In attempting to classify diseases on a geographical basis three factors must be taken into consideration—the physical environment, the pathogen, and man. It is possible to plot the relationship between the first two, but the presence of the third factor renders the situation extremely complicated for the reason that while the first factor is static, the second is relatively mobile and the third, man, is extremely mobile. For this reason no disease can be said to have a permanent geographical distribution.

Within the limits of these considerations, a classification of diseases on a geographical basis, by grouping together all those diseases that are found mainly or solely in tropical latitudes, and all those that are found mainly or solely in temperate latitudes, reveals some significant correlations. Table 18 lists the major diseases, the causes or transmission or optimum growth of which are directly or indirectly dependent upon temperature conditions. It will be seen that the number of diseases prevalent in tropical areas is more than twice the number prevalent in temperate areas. In the words of Clemow, 'In most tropical or sub-tropical lands all, or nearly all of the ordinary diseases of temperate climes are found to exist, while there are others that are unknown in the latter. The disease flora is, in brief, richer in the warmer regions of the earth.'[2] There is, therefore, a greater likelihood of man in the tropics being infected by one or more of the diseases. The chances of infection are greatly multiplied in the case of a rural population living on an inadequate and badly balanced diet, in insanitary surroundings and without adequate medical facilities.

There is also a correlation between seasonal variations in temperature and the prevalence of certain diseases in different latitudes. Winslow and Herrington have found that one group of diseases—malaria, yellow fever, bubonic plague, typhoid fever and cholera—is prevalent at warm seasons and in warm climates, while another group—diphtheria, measles, scarlet fever, pneumonia and typhus fever—is more common at cold seasons and in cold climates.[3] The communicable diseases (for example the respiratory infections) tend to show an increase in the cool or cold seasons, and intestinal infections in the warm or hot seasons. This is stated to be due to direct physiological responses to temperature which govern the power of the nasal and oral mucosa and the intestinal mucosa to resist infection.[4] Other factors too play a part. Thus Clemow reports that lessened

1. J.M. May, 'Medical Geography, its Methods and Objectives', *Geographical Review*, Vol. XL, No. 1, 1950, p.9.
2. F.G. Clemow, *The Geography of Disease* (Cambridge, 1903), p.16.
3. Winslow and Herrington, op. cit., pp.225-56.
4. Ibid., p.251.

TABLE 18: NUMBER OF MAJOR DISEASES PREVALENT MAINLY IN TROPICAL AREAS AS COMPARED WITH THE NUMBER OF DISEASES PREVALENT MAINLY IN TEMPERATE AREAS [1]

DISEASES FOUND MAINLY IN THE TROPICS	
NAME	REMARKS
Ankylostomiasis	Extremely common in tropics
Blackwater Fever	Very frequently found along larger river valleys, especially in Tropical Africa
Cholera	Though of world-wide distribution, remains endemic for very long periods only in tropics
Dengue Fever	Though epidemics occur in cool countries, mainly prevalent in tropical and sub-tropical areas
Diarrhoeal Disorders	Causes ubiquitous; generally the degree of commonness and severity increases with the warmth of the climate
Guinea-Worm (Filaria mendinensis)	Almost confined to tropical and sub-tropical areas, especially to Africa
Filariasis	High temperatures essential for both the filaria and the vector mosquitoes. Indigenous to regions between 35°N and 30°S.
Dysentery	Though of complex distribution, appears to increase in severity and degree of prevalence with increasing proximity to Equator
Liver Abscess	Mainly a hot climate disease
Malaria	Though world-wide, prevalence and intensity increase towards Equator
Sleeping Sickness	Entirely tropical, especially common in Africa
Tetanus	Tropical conditions more favourable to Tetanus bacilli
Yellow Fever	Absent where mean winter temperature below 65°F.
Most Skin Diseases	Widely prevalent in tropics
DISEASES FOUND MAINLY IN TEMPERATE AREAS	
Cerebro-Spinal Fever	Some degree of cold necessary for its occurrence
Diphtheria	A disease mainly of the Temperate Zones
Rickets	Rare in tropical and sub-tropical areas
Scarlet Fever	Rare in tropical and sub-tropical areas
Typhus Fever	Disease of the Temperate Zones; definitely related to temperature
Whooping Cough	Though spread over all latitudes, a more severe disease in cool climates

Source: F.G. Clemow, *The Geography of Disease* (Cambridge, 1903), passim.

ventilation, over-crowded housing and diminished sunlight during the cool or cold season of the year also influence the prevalence and distribution of respiratory diseases.[2] Stone maintains that the common intestinal and gastric complaints in

1. See also Lee, op. cit., Table 15, pp.101-3.
2. Clemow, op. cit., p.16.

the tropics are due to an overwhelming carbohydrate diet, which seems to induce a susceptibility to intestinal infections.[1]

In the tropics where seasonal variations are characterized less by temperature than by rainfall fluctuations, the prevalence of some diseases shows a distinct relationship to wet or dry periods. In the Philippines, for instance, the four helminthic diseases—filariasis bancrofti, hookworm, paragonimiasis westermani and schistosomiasis japonica—are most common in those regions where the annual rainfall is evenly spread out, and where moisture conditions favour the propagation of the different parasitic worms.[2]

Climate and Insect Vectors. Numerous diseases of particular severity and widespread distribution throughout tropical areas are caused by the introduction of the disease-bacilli into the human body by an intermediary agent known as the disease vector. The life and activity of these vectors are directly influenced by the physical environmental factors.[3] Insects are probably the most important of these vectors in the tropics, because of the extent, number, and severity of the diseases they help to spread. They are carriers of trypanosomiasis through much of tropical Africa, malaria throughout the tropical world as well as in parts of the temperate areas, and various tropical fevers such as yellow, blackwater and dengue fever. Not only are insects carriers of human disease, but they also adversely affect agricultural production in both tropical and temperate areas by attacking crops. Depredation is especially serious in the tropical areas, and varying proportions of the tropical peasant's crops are lost yearly through insect attack, and the lack of organized pest control.

It has been established that temperature and air moisture are the critical factors that regulate the population of a given insect species. Certain temperature and humidity conditions form an optimum combination, and any departure from the optimum results in a shortening of insect life.[4] Research at the Rothamsted Agricultural Experimental Station confirms the view that changes in the size of insect populations are dependent upon meteorological conditions, acting both directly on the insect and indirectly through their effects on insect parasites or the host plants. It was also found that although rain, wind, humidity and atmospheric pressure all had their effects on insect activity, the most important factor was temperature.[5] Fig. 11 shows the reaction of insects to changes in temperature. In the optimum temperature zone all activities are vigorous. Below this zone lies that of cold stupor, dormancy and hibernation, and finally death. Above the optimum zone lies that of temporary heat stupor, culminating ultimately in heat paralysis and death as the temperature increases.

Not only are insects most active at temperatures between 77°F to 86°F but Uvarov found that the processes of their physiological development are accelerated at higher temperatures within the optimum limits, so that certain insects which

1. Stone, 'Health in Tropical Climates', in *Climate and Man* (Washington, 1941), p.256.
2. M.A. Tubangui, 'Schistosomiasis and other Helminthic Diseases in the Philippines', *Proceedings of the Fourth International Congresses on Tropical Medicine and Malaria* (Washington, 1948), Vol. II, Fig. 1, p.1035.
3. May, op. cit., pp.14-15.
4. F.S. Bodenheimer, 'What Factors Regulate in Nature the Number of Individuals of Insect Species?', summarized in *Bibliography of Literature on Agricultural Meteorology, Section* 2, *Extracts and Summaries* (London, 1932), para. 483; also W.C. Cook, 'A Bioclimatic Zonation for Studying the Distribution of Injurious Insects', *Ecology*, Vol. X, No. 3, 1929, pp.282-93.
5. C.B. Williams, 'Fluctuations in Insect Populations as Related to Weather Conditions' *Qrtly. Jrn. Roy. Met. Soc.*, Vol. LXXI, No. 309-310, 1945, p.222.

complete only one life cycle in a year in the colder climates attain several generations in a year in the warmer climates. The actual number of progeny produced by those insects which are capable of procreating several generations a year varies according to the latitude, the warmer latitudes being most favourable to greater reproduction.[1]

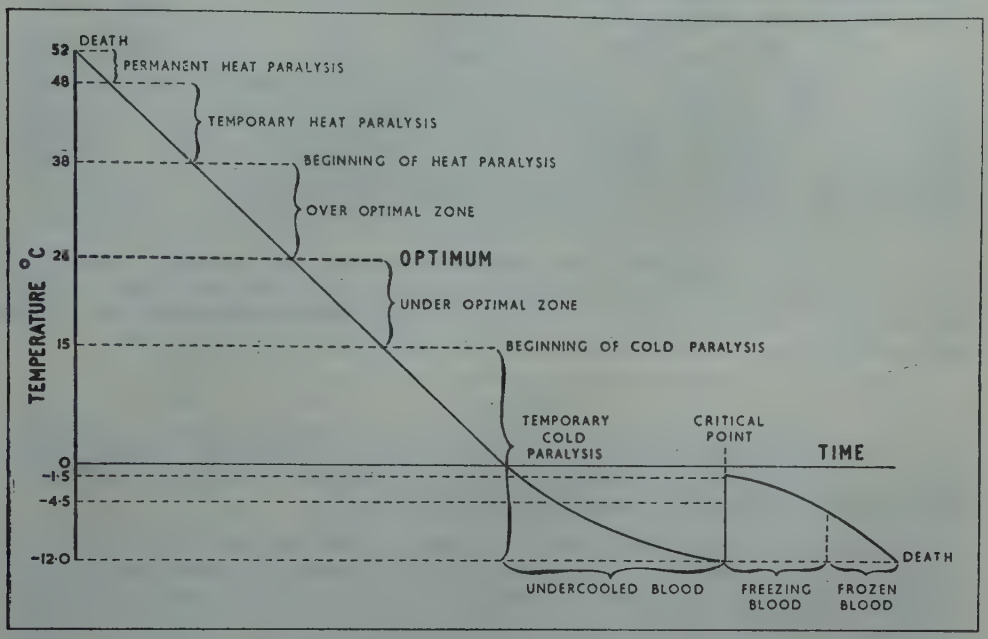

Fig. 11. The Reaction of Insects to Temperature.

Source: Ed. Handschin 'The Effect of Soil Temperature on the Behaviour and the Migration of Soil Fauna' in *Report on Agricultural Meteorological Conference, 1928* (Meteorological Office, London, 1928), Fig. 1.

Note: The optimum temperature lies between 25°C (77°F) and 30°C (86°F) where all movements are harmonious and life progresses normally. When the outside temperature exceeds 30°C the insects become restless and they try to evade the zone of uncomfortable temperatures by flight. If this is not possible, and especially if there is rapid heating to 40°C, swoon-like conditions occur and a heat paralysis takes place which leads to death if a cooling process does not intervene and bring the body and outside temperature down again.

Different features are shown when temperatures fall below optimum. The first important temperature limit is about 15°C (59°F), below which the insects lose the power of locomotion and migration as the result of paralysis of the moving centres. With further cooling, the blood does not freeze directly but only after prolonged exposure to temperatures below 0°C when death occurs at the moment of the freezing and crystallizing of the supercooled blood fluid.

The occurrence of death through heat and cold is in direct relation to time. Acceleration of the onset of hot or cold conditions brings the insects more rapidly into the lethal zone, and if they are not able to evade the conditions, they perish.

Insect activities are therefore at their maximum at temperatures normal in most months in the tropics. Such temperatures are, however, reached only during the warm season in the temperate areas. The depredations of insect pests and vectors in the tropics can continue without a break throughout the year, whereas

1. B.P. Uvarov, 'Weather and Climate in their Relation to Insects', *Conference of Empire Meteorologists, 1929, Agricultural Section, II, Papers and Discussions* (London, 1929), pp.132-3.

the chain of insect activities in the higher latitudes is broken for a long period every year during the cold season. At the same time the rapid rate of insect reproduction in the tropics results in several periods of injurious activities by a single species in a year. In the temperate countries, a single species of insect may reproduce itself only once a year, or once in several years, so that its activities are accordingly restricted.

It is apparent from these findings that the chances of the tropical peasant having his crops reduced by insect pests, his livestock attacked by disease spread by insect vectors, and his own health undermined through infection from germ carrying flies, mosquitoes, and other insects, are greater than those of a peasant living in the temperate areas. It is not possible, however, to measure these statistically because the final and visible outcome in the loss of crops, livestock and human health is linked with a complexity of other causes and part causes.

In the remaining sections of this chapter the more important and wide-spread tropical diseases, caused by micro-organisms spread by insect and other vectors and parasites, will be examined in greater detail. Their distribution and their relationship to rural development in the tropics will also be considered.

MALARIA

Sir Ronald Ross discovered, in 1897, that the anopheline mosquito was the carrier of malaria.[1] Subsequent research showed that yellow fever and many other tropical diseases were spread by the same insect.

Malaria is perhaps the most widespread of all tropical diseases. Besides being highly endemic in the tropics, malaria is also endemic for some distance into the temperate zones, but with diminishing severity and frequency towards the higher latitudes.[2] Africa, south of the Sahara, is perhaps the most intensely malarious area in the tropics.[3] Malaria is hyperendemic in the foothill and upland areas of the Philippines, Indochina, Thailand, Burma, Indonesia and Malaya, though the flooded padi-fields in the coastal lowlands are relatively free from it.[4]

Malaria is not a static disease confined to certain climatic or physiographic zones, but is continuously changing in intensity from time to time and from place to place. In the long history of the disease its spontaneous disappearance has frequently been observed in some marginal zones, while in others it has flared up because man's interference with the ecological balance made conditions more favourable for intensified breeding of the vectors.[5]

Both the distribution of human malaria and its intensity are closely related to the distribution of the various species of anophelines, which have in their turn different bionomics, ecological characteristics, and breeding habits. The disease is transmitted to man through the injection of the progeny of the malaria parasite. This takes place when an infected mosquito bites a person. The two common types of malaria fever are caused by different species of the parasite of the genus

1. Sir Ronald Ross, 'Tropical Medicine', *Tropical Agriculture,* Vol. II, No. 1, 1925, pp.1-3.
2. J.S. Simmons, 'The Malaria Control Program of the U.S. Army during World War II', *Proceedings of the Fourth International Congresses on Tropical Medicine and Malaria* (Washington, 1948), Vol. I, Fig. 1, p.827.
3. A.L. Hoops, 'A History of Malaria', *Malayan Med. Jrn.,* Vol. IX, No. 3, 1934, p.130; and Clemow, op. cit., pp.253-8.
4. K.J. Pelzer, 'Geography and the Tropics', in G. Taylor (ed.) *Geography in the Twentieth Century* (London, 1953), pp.335-41.
5. Hoops, op. cit., pp.123-40.

Plasmodium. Plas. vivax causes the widespread tertian form of malaria, and *Plas. falciparum,* which is essentially tropical in distribution, is responsible for the dangerous sub-tertian malignant form of malaria.

Within the three factor complex of man-mosquito-plasmodium, the last two have close and direct relationships with the physical environment, especially with climate but also with water and soil. It was discovered, for instance, that low temperatures inhibit the development of the *plasmodium* in the mosquito, and, on the basis of this, it has been found possible to define the areas and seasons which would be likely to be dangerous from the point of view of malaria infection.[1] The mosquito vector is highly sensitive to variations in relative humidity, and it needs high humidity at an optimum temperature to be able to transmit the disease. The following range of minimum relative humidity for different species has been established: *A. fuliginosus* 38 to 40 per cent; *A. subpictus* and *A. stephensi* 55 to 58 per cent; and *A. culicifacies* 57 to 62 per cent. At a relative humidity of under 52 per cent *Culex fatigans* (the main vector of filariasis) cannot be induced to bite, and at a low relative humidity the mosquito cannot survive because of dessication.[2]

The mosquito requires water to breed in. Heavy rainfall, apart from causing the high relative humidities necessary for the survival of the mosquito, is likely to increase the incidence of malaria by increasing the number of breeding locations. The equatorial tropics with heavy and constant rainfall are hyperendemic malarial areas. In the sub-tropics, with seasonal fluctuations in rainfall, malaria is more likely to be endemic, it may also occur in epidemic waves.[3] A period of drought in the equatorial tropics may also lead to epidemics, because of the local drying up of streams and water courses and the formation of stagnant pools of water which favour the breeding of certain species of mosquitoes. Temperature is also important as a factor in the distribution of malaria. The disease is rare in areas where the coldest month has a mean temperature of less than 16°C (60.8°F).

MALARIA IN MALAYA

Of the forty-one recorded species and sub-species of anophelines in Malaya only six are recognized malaria vectors: *A. maculatus; A. umbrosus; A. letifer; A. barbirostris; A. sundaicus;* and *A. baezai.*[4] Other vectors responsible for occasional outbreaks in local areas are *A. hyrcanus* (also responsible for the transmission of filariasis in north Malaya), *A. minimus,* and the vector form of *A. leucosphyrus*-restricted to north-west Malaya where the transitional monsoon type of climate appears to favour their development.[5]

1. C.A. Gill, 'The Influence of Humidity on the Life History of Mosquitoes and on their Power to Transmit Infection', *Trans. Roy. Soc. Trop. Med. & Hyg.,* Vol. 14, 1921, pp.77-83. The optimum temperature for the sexual cycle of the parasite is: for *Plas vivax* 78°F; for *Plas. falciparum* 82°F; and for *Plas. malariae* 71.6°F. J.M. May, 'Map of the World Distribution of Malaria Vectors', *Geographical Review,* Vol. XLI, No. 4, 1951.
2. B. Mayne, 'A Study of the Influence of Relative Humidity on the Life and Infectibility of the Mosquito', in *Bibliography of Literature on Agricultural Meteorology, Section 2, Extracts and Summaries* (London, 1932), para. 622.
3. The usual definition of endemicity is based on the length of time in which the disease is prevalent. Thus hyperendemic means all year round; endemic, more than six months; moderately endemic, less than six months; and epidemic, occasional or spasmodic.
4. S.C. Howard, 'The Practical Application of Anti-Malarial Measures on Malayan Estates', *I.M.R., Bulletin No. 2 of 1939* (Kuala Lumpur, 1940) p.1. For a detailed description of all the species of anophelines recorded in Malaya, see B.A.R. Gater, *Aids to the Identification of Anopheline Larvae* (Singapore, 1934), and E.P. Hodgkin, 'The Transmission of Malaria in Malaya', *I.M.R. Study No. 27* (Kuala Lumpur, 1956).
5. J.W. Field and R.A. Reid, 'Malaria', *The Institute for Medical Research, 1900-1950* (Kuala Lumpur, 1951), pp.136-8.

Malaria is hyperendemic throughout most of Malaya (Fig. 12). Although climatic conditions are continuously favourable to mosquito life and larval development, each species is limited in its distribution by its own peculiar breeding habits. Knowledge of these habits enables malarialogists to define with reasonable accuracy the location and distribution of the principal vectors. There is an intimate correlation between surface units in the Peninsula and the distribution of these main vectors, the link being the individual preference for conditions of water and shade for breeding as found in the different surface forms. Working inland from the coast towards the higher land, three zones of distribution may be distinguished.[1]

(1) *The brakish water coastal zone.* This is characterized along the west coast by long stretches of mangrove swamp, and along the east coast by tidal lagoons. The chief vector found here is *A. sundaicus,* and a species of lesser importance is *A. baezai* known also as the 'saltwater umbrosus'. Both these species breed in brackish water, and consequently tend to be concentrated along the tidal zone. *A. baezai* differs from *A. sundaicus* in preferring water with some shade over it. *A. sundaicus* breeds profusely in still brackish water open to the sunlight, but does not breed under dense natural shade or in strong currents. Tidal lagoons, formed by silting and with still brackish water exposed to sunlight and with some green algae over it, provide ideal breeding locations. Such locations are found all along the sandy littoral of eastern Malaya. Natural conditions of mud and dense mangrove shade do not favour the multiplication of these mosquitoes along the west coast. But the process of economic development on the west coast has interfered with these natural conditions and brought with it 'man-made' malaria. The large areas of mangrove felled indiscriminately to supply the fuel and timber needs of the tin-mines of Perak and Selangor, encouraged prolific breeding of *A. sundaicus.* Salt water which had collected in stagnant pools over the cleared land became diluted with rainwater to form a brackish mixture ideal for the mosquito.[2] Drains and other outlets along which salt water can mix with fresh

Fig. 12. Endemicity of Malaria in Malaya. Source: *Map S.E.A./Misc./11530* (Survey Department, 11 Army Group).

1. B.A.R. Gater and P.D. Rajamoney, 'A Summary of the Records of Anopheline Breeding Places in Malaya', *I.M.R., Bulletin No. 2 of 1929* (Kuala Lumpur, 1929); Field and Reid, op. cit., pp.127-77; Howard, op. cit., passim; and Hodgkin, op. cit., passim.
2. B. Barrowman, 'Notes on a Demonstration of Malaria Control', *Malayan Med. Jrn.,* Vol. XI, No. 1, 1936, p.14.

water are also breeding places. Here the inland limit of *sundaicus* distribution varies with the tidal range. Sudden and violent epidemics, with which this vector is particularly associated, may occur under exceptional circumstances as when seawalls are flooded by storm waves or spring tides leaving behind, on the inland side, pools of brackish water in which the vector breeds.[1]

(2) *The zone of flat coastal and deltaic plains.* This is unmodified by man in eastern Malaya except in the Kelantan Delta and parts of the Pahang and Trengganu Deltas, but developed or being developed for agriculture in western Malaya. This is a zone of large continuous stretches of alluvial plains with slow meandering rivers and inundated, permanently or periodically, to form fresh-water swamps. There are three main vectors here—*A. umbrosus, A. letifer* and *A. barbirostris.* The first two breed in shaded stagnant water discoloured by decaying vegetation. *A. umbrosus* is more common in the denser shade of thick vegetation. *A. letifer* breeds in the slightly lighter shade of cultivated and semi-cleared land. *A. barbirostris* breeds in the open swamps, and is common in the padi-fields and abandoned mining pits covered with coarse vegetation. Removal of shade from the breeding locations kills most of the *barbirostris* larvae, but their elimination in practice is a formidable task because the larvae are only a quarter of an inch in length, and the vegetation needs to be only a few inches high to be shady enough for them. Keeping the undergrowth down in order to eliminate the larvae is almost impossible in the hot wet climate of Malaya, except in very restricted areas, and then it can be achieved only after prohibitive expenditure of time and money. There is heavy breeding of *A. barbirostris* during the height of the padi season, when the growing plants standing in stagnant water provide good conditions for the larvae.[2]

(3) *The foothill and upland zone.* This coincides with the Tin and Rubber Belt of western Malaya. This zone is still little developed in eastern Malaya. The main and most dangerous vector in the Peninsula—*A. maculatus*—is found here. The natural habitat of *A. maculatus* is the clear, sunlit, unshaded waters of running streams. The larvae are provided with small hooks so that they can attach themselves to vegetation and other objects and so maintain their position against a considerable current. The mosquito is present in all hilly land up to 5,000 feet, but absent in the plains. The dark, peaty water in which *A. umbrosus* and *A. letifer* breed is fatal to *maculatus* larvae, and there is a definite line beyond which the mosquito will not lay her eggs. *A. maculatus* is not generally found in large bodies of water or under dense shade, but prefers seepage or small streams with grassy edges.

This vector was responsible for the very high death-rates among rubber estate workers when rubber was first introduced on a large scale in the country. The clearing of forest and undergrowth for agricultural development along the western foothill zone broke the protective cover and the jungle shade, and *A. maculatus* multiplied in ever increasing numbers, causing correspondingly high malarial infection among the labourers. In 1911, for example, 9,000 out of the total rubber estate labour force of 143,600 died from malaria, and the number infected (but not fatally) was very much higher.[3] The establishment of a shade cover over water in hilly areas seems to be the logical control measure against

1. Ibid.
2. W.J. Vickers and J.H. Strahan, *A Health Survey of the State of Kedah, with Special Reference to Rice Field Malaria, Nutrition and Water Supply, 1935-36* (Kuala Lumpur, 1937), pp.11-20.
3. *Federation of Malaya, Annual Report of the Medical Department, 1952* (Kuala Lumpur, 1954), p.14; also the *Straits Times,* 9th July, 1956 and 29th June, 1957.

maculatus, but to be effective the shade must be complete and unbroken. Plants which lose their leaves at any time cannot be used. Depressions capable of retaining water, such as earth wells, silt pits, isolation drains, holes caused by uprooted trees, and even cattle hoof marks are potential breeding places.

This survey of the breeding locations of the malaria vectors in the Peninsula has illustrated the correlation between surface units and the distribution of the different anopheline species. Although it occurs in the three physical units of coast, inland swamps and foothills, it is more intense in the hilly areas than in the lowlands. The difference in disease intensity in the foothill and lowland areas has also been observed in other parts of the South-east Asian tropics.[1] The possible reasons for this difference have been advanced by Williamson, who considers that there is a relationship between the distribution of vectors in Malaya and the chemical properties of their breeding waters, the purity of the waters being defined in terms of different degrees of oxygenation, which in turn depend upon the amount of organic nitrogen present. The organic nitrogen content is determined by the soil properties, and the amount of decaying vegetation present in the water. Thus the absence of *A. maculatus* in the padi-fields is due in part to the large oxygen demand of both the living and dead roots of the padi-plants. The *maculatus* larvae are unable to survive in such areas because of the lack of oxygen. The waterlogged swamps and coastal plains with stagnant water, having a high nitrogenous and organic but low oxygen content, are likewise inimical to *maculatus* as well as to other larvae which need clear water.[2] The decisive factors which regulate *A. maculatus* breeding are (1) the configuration of the land which determines its drainage and the organic content of the water, and (2) human interference in the course of settlement and agriculture, or other economic development which necessitates clearing the forest. The light which falls upon the clear waters of hill streams enables algae to synthesise food which directly or indirectly nourishes the mosquito larvae.[3] Corbet suggests that since the number of *maculatus* anophelines is at a minimum in areas where anaerobic biological processes take place, deliberate contamination of breeding areas with organic debris may be used as a method of control.[4]

Because climatic conditions in Malaya are continuously favourable to mosquito breeding, and also because of the lack of seasonality, it would be expected that the incidence of malaria would be fairly even through the year. In fact, there appear to be definite variations in the incidence of the disease, the peaks and lows of infection coinciding with certain months of the year in different localities. The normal expectation is that the periodicity of malaria should depend upon fluctuations in vector numbers, which in turn depend upon changes in the number and extent of the breeding places caused by variations in the rainfall. This appears to be true as far as lowland malaria is concerned.[5] *A. sundaicus*, *A. baezai*, *A. umbrosus*, *A. letifer* and *A. barbirostris*, the vectors of lowland malaria, all show a steady rise in numbers towards the end of the year when rainfall is slightly heavier because of the North-east Monsoon. In the case of *A. sundaicus* the numbers also vary with the rise and fall of the tides, and *A. barbirostris* varies with the cycle of padi cultivation activities, being greatest during the season when

1. Pelzer, op. cit., pp.335-41.
2. K.B. Williamson, *The Nitrogenous and Total Organic Content of the Soil in Relation to Malaria* (Penang, 1928), pp.15-16.
3. Ibid., p.9.
4. A.S. Corbet, *Biological Processes in Tropical Soils, with special reference to Malaysia* (Cambridge, 1935), pp.80-1.
5. Field and Reid, op. cit., pp.150-1.

the plants are growing in standing water. However, where the vector of hill malaria—*A. maculatus*— is concerned, the situation becomes more complicated. Whereas the other vectors show moderate increases which correlate with the distribution and amount of rainfall, *A. maculatus* shows a fourfold and fivefold increase during its peak breeding months which cannot be explained solely in terms of breeding locations and rainfall, because the increase in rainfall during the peak breeding season is not large enough to account for the rise in vector numbers. This remarkable periodic increase in vector numbers was noticed by Sir Malcolm Watson as early as 1901. He called it 'the maculatus wave.'[1] Since then further evidence has confirmed that the 'wave' is common throughout hilly locations in the Peninsula, in rubber estates as well as peasant rural areas.[2]

The existence of peaks and lows in *maculatus* infection complicates the planning of any programme for malaria control in the foothill zone. Apart from this departure, the normal picture of malaria in the Peninsula is one of high endemicity over all areas, and the chances of infection by the population equally great all the year round, especially amongst peasants in rural areas where control measures are negligible, and in most cases totally absent. The local pattern of infection, however, depends on the interaction of the biological habits of the vectors, the physical factors determining the breeding locations, and the activities of the human population. The first two have been examined. It now remains to consider the human factor.

The Malaria Pattern in the Rural Economic Landscape. A definite relationship exists between the distribution of malaria vectors and the distribution of the rural population, as well as the nature of their economic occupations. An examination of the maps of Malaya showing land-use (Fig. 3), the regions subject to malaria (Fig. 12) and the distribution of the primary rural population (Fig. 4) reveals two prominent facts. Firstly, the traditional Malay peasant landscapes of padi, coconuts, fruits and fishing along coastal and deltaic locations in the north-east (Kelantan), the north-west (Perlis and Kedah), along the east coast from Kelantan to the Pahang Delta, at intervals along the west coast (the Krian and Sungei Manik padi areas, and the coastal stretch from Malacca to the south-western extremity of Johore), are regions of low malaria endemicity. For example, a recent examination of 2,147 school children in Trengganu revealed that those living in the flat riverine areas appeared to have a low incidence of malaria.[3] An earlier survey of malaria in Kedah had also shown that a low incidence of the disease prevailed among the peoples who lived in the flat coasal padi areas.[4] This low incidence has been attributed to the processes connected with wet-padi cultivation, some stages and consequences of which have been proved unfavourable to the anopheline vectors. The vegetative matter rotting in padi-fields after the harvest suppresses or modifies mosquito-breeding.[5] It must also be noted that the low incidence of malaria exists only in the long established padi areas where settled conditions prevail. In pioneer padi areas, as in parts of the Pahang Delta, sharp and intense local outbreaks follow on the modification of the natural

1. Sir Malcolm Watson, *The Prevention of Malaria in the Federated Malay States* (London, 1921), pp.344-9.
2. The problem has been thoroughly examined by P.S. Selwyn-Clarke, 'The Seasonal Prevalence of Malaria in the Federated Malay States', *Malayan Med. Jrn.*, Vol. VI, No. 3, 1931, pp.67-81. T. Wilson has suggested that besides rainfall, these peaks of the malaria curve might be correlated with periods of high wet-bulb temperatures, see 'Meteorological Factors as Affecting the Incidence of Malaria'. *Malayan Med. Jrn.*, Vol. X, No. 2, 1935, pp.39-48.
3. *Federation of Malaya, Annual Report of the I.M.R., 1953* (Kuala Lumpur, 1954), p.71.
4. Vickers and Strahan, op. cit., p.27-8.
5. Williamson, op. cit., pp.10-11.

environment and the introduction of a susceptible population into the areas. Secondly, the western Tin and Rubber Belt is a zone of intense malarial activity. Here is located the bulk of the non-peasant population of Malaya, as well as that part of the peasant population engaged in rubber cultivation and in market-gardening. The main vector is *A. maculatus,* breeding prolifically wherever a break in the forest cover exposes the hill streams to sunlight. The clearing of the jungle for tin-mining and rubber cultivation was followed by severe, and sometimes catastrophic, outbreaks of malaria in the days before the correct control measures were adopted. The establishment of a rubber smallholding by a peasant smallholder who is not familiar with, and who cannot afford to adopt, these measures remains a hazardous affair. The malaria rate amongst this section of the rural population is high. A house to house examination in 1940 of a typical Malay peasant village (Sungei Tua), situated in a narrow valley about ten miles north of Kuala Lumpur, showed a malaria parasitic rate of 22 per cent and a spleen rate of 32 per cent amongst its population, with higher percentage rates in the lower age groups.[1] Another examination, this time of the hilly Batu Rakit-Gemuroh area of Trengganu in 1953, revealed parasitic rates of 30 to 45 per cent and spleen rates of 60 to 90 per cent in children of 6 to 12 years.[2]

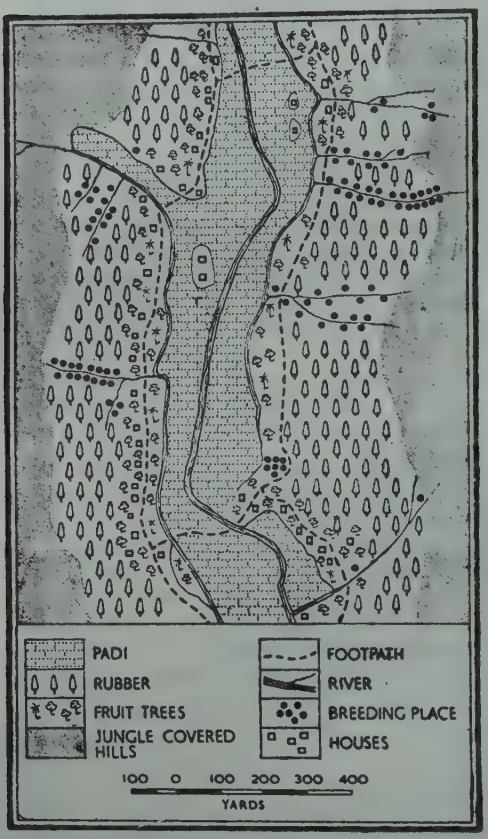

Fig. 13. The Inas Valley (Negri Sembilan), showing Distribution of Houses in Relation to Padi-Fields and Breeding Places of *A.Maculatus.* Based on J.F.B. Edeson and Others 'Final Report . . . on Experiments in Rural Malaria Control in Malaya, 1948-1952', *I.M.R. Research Report No. 39* (Kuala Lumpur, 1954) Fig. III.

There are also transitional variations to this simple pattern of coastal and foothill malaria. Thus a site which is exposed to both types of malaria will tend to be more severely affected than another which is exposed to one form only. The hill-and-valley landscape of Negri Sembilan, for example, is affected by both types of malaria. Along the narrow valley bottoms planted with wet-padi, ricefield-malaria prevails, while along the break of slope where the peasant houses are situated amidst tree crops, hill-malaria is rife. A typical hill and valley peasant landscape is that of the Inas valley (Fig. 13).

THE HISTORY OF MALARIA CONTROL IN MALAYA

The control of malaria in a hyperendemic region, such as the Malay Peninsula, necessitates a constant battle against mosquito-breeding, a battle rendered specially difficult owing to the year-round multiplication of the vectors. It entails

1. *Federation of Malaya, Annual Report of the I.M.R. 1940* (Kuala Lumpur, 1941), pp.64-74.
2. *Federation of Malaya, Annual Report of the I.M.R., 1953,* p.71.

the expenditure of large sums of money and the employment of a large and skilled labour force. In a young tropical economy where both funds and skilled labour are scarce, the normal procedure would be to extend the benefits of malaria control to the largest possible population against a given expenditure. Thus it was that in most underdeveloped tropical countries only the urban population, the organized labour forces, and other similar concentrations of people, came within the compass of such control schemes as were extant. The peasant population, dispersed over wide areas, was neglected.[1] This procedure was also followed in Malaya.

The first requirement which had to be met in the control of malaria was a detailed knowledge of the breeding habits of the anopheline vectors. The period of discovery in Malaya, pioneered by Ross and Watson, was also a period of experimentation in control methods. In 1901, Watson drained the swamps around Klang as a test of the validity of Ross' theory for the cause and prevention of malaria. The test was successful and similar work was carried out at Port Swettenham, and later extended to other towns in the Federated Malay States.[2] Both Klang and Port Swettenham are lowland towns sited near swamp land where *A. umbrosus,* a shade-lover, was the main vector. The extension of the method of drainage and exposure of the breeding places, effective for *umbrosus,* made the malaria situation worse in the inland towns instead of alleviating it, because clearing the shade from the inland hill streams and other water bodies resulted in a swelling of numbers of the hill vector *A. maculatus.* The method used for Klang near the coast when extended to Kuala Lumpur, twenty-three miles inland, proved a failure and increased the incidence of malaria. In 1907 the total death-rate in Kuala Lumpur was 37.9 per 1,000 and the malarial death rate stood at the figure of 9.7 per 1,000.[3]

The same error was made in trying to control malaria in estates when rubber was first planted on a large scale. Seafield Estate in Batu Tiga, Selangor, for example, was one of the first rubber estates to adopt the new measures. All the vegetation from the banks of the streams which ran through the estate was cleared, and it was not until 1909 that it was realized that the vector here had different breeding habits from that of *umbrosus.* During the period before the rectification of the mistake, the death-rate among the adult labourers stood at 144 per 1,000 per annum.[4]

Subsequently new methods of attack were tried for foothill malaria, and one of the most effective evolved was subsoil drainage, whereby all running water was led underground by drainage pipes out of the reach of the anophelines.[5] This method, however, was expensive and consequently more suited to urban areas than to estates. It was tried in Kuala Lumpur and proved most effective, the malarial death rate falling from 9.7 per 1,000 in 1907 to 4.2 in 1920.[6]

The discovery that the main vector in the foothill and upland regions of the Peninsula was *A. maculatus,* and that it could be kept down by simply

1. G. Macdonald, 'The Present State of Malaria Control', *The Colonial Review,* Vol. V, No. 8, 1948, pp.241-2.
2. Sir Malcolm Watson, 'Twenty-Five Years of Malaria Control in the Malay Peninsula,' *British Malaya,* Vol. II, No. 9, 1927, p.245.
3. *Federated Malay States, Annual Report of the Medical Department, 1919* (Kuala Lumpur, 1920), pp.15-16.
4. B. Barrowman, 'An Example of Anti-Malarial Subsoil Drainage under Rural Conditions', *Malayan Med. Jrn.,* Vol. VII, No. 4, 1932, pp.116-8.
5. Sir Malcolm Watson, 'Twenty-Five Years of Malaria Control in the Malay Peninsula', p.246.
6. *Federated Malay States, Annual Report of the Medical Department for 1920,* (Kuala Lumpur, 1921), pp.14-15.

preserving the dense shade of the jungle over the hill streams, marked a significant phase in the history of malaria control in Malaya. But to be effective, such a method of control must be based on the establishment of a continuous dense shade-cover over the hill streams and seepage areas. The cover must remain unbroken by roads, paths, cart-tracks, and such like. This was an extremely difficult task in a country where agricultural, urban, and other material forms of economic expansion and development have always been marked by preliminary forest clearing. An alternative had to be found. It was later discovered that a mixture of crude oil and kerosene when poured over the water completely destroyed the mosquito larvae. This was an inexpensive method of control suitable for application in estates and urban areas.

Thereafter the effective methods of malaria control were based on a knowledge of the individual breeding habits of the vectors, and aimed at the destruction of their larvae rather than the mosquitoes themselves, either by reducing or removing the breeding places, or by killing the larvae with a larvicide such as the oil mixture, or by a combination of both. Along the coast, where *A. sundaicus* breeds, bunds and tidal gates were constructed in towns and estates to exclude the sea water necessary for *sundaicus* propagation.

Direct governmental action against malaria took the form of the creation of a Health Branch of the Medical Department in 1910. The duties of this Branch were the supervision and control of health work, including anti-malaria work in estates and mines. The next year the Malaria Advisory Board was formed which was concerned with malaria research, advising the Government of the Federated Malay States on the anti-malarial schemes to be carried out, and the co-ordination of anti-malarial efforts.

Health Officers were appointed in the towns to look after the control of malaria. The main difficulty was finance. All major anti-malarial work was expensive, but in the towns the expenses were considerably reduced because of the high population density. In Kuala Lumpur, for example, it was estimated that the cost of routine anti-malarial work was 35 to 40 cents per head per annum. The site of Kuala Lumpur is similar to that of many inland towns in the Tin and Rubber Belt of Malaya from the standpoint of malaria prevalence, with a river passing through the centre of the town, hills at the sides which are very dangerous as breeding haunts of *maculatus,* and low-lying and often marshy flats at the break of slope which harbour the less dangerous lowland vectors. Anti-malarial measures carried out in Kuala Lumpur may therefore be taken as typical of those carried out in other towns. These measures include subsoil drainage on hill-slopes, drainage of swamp land, and the canalization of the river banks. Control measures were extended for a minimum of half a mile beyond the town limits to prevent the infiltration of mosquitoes from outside. The edges of lakes, ponds, and other water bodies were cleared of vegetation and the water oiled, while larvae-eating fish were introduced wherever necessary. A series of by-laws made the notification of any case of malaria compulsory, and grazing and straying by-laws prevented anophelines from breeding in water collected in hoof-marks.[1]

The problem of finding a cheap and efficient means of malaria control in rubber and other estates was solved when oiling superseded subsoil drainage. All the estates were required by the Labour Code to safeguard the health of their labourers, and anti-malarial work was carried out in pursuance of this regulation. This work was done at the owner's expense and with the help of the local Health Officer. The larger European estates also established their own hospitals within

1. W.E. Holmes, 'The Control of Urban Malaria', *I.M.R. Bulletin No. 2 of 1939,* (Kuala Lumpur, 1940), pp.13-7.

the estate boundaries. The normal method of control was based on the flying range of the anopheline, which was taken to be half a mile, though it was discovered later that the mosquito could fly further than this.[1] Preventive measures were usually carried out in a circle of half a mile radius around the main group of buildings (manager's house, labourers' quarters, and factory), with secondary extensions made to include all other buildings. All streams, ravines, seepage and swamp areas in the control radius were either drained or regularly oiled. With the increasing use of drug prophylaxis, the rate of malaria incidence in estates fell spectacularly.[2] Malaria was the chief cause of mortality among estate labourers, and an indication of the success of these anti-malarial measures is the progressive fall in the death rate per thousand from 62.9 in 1911 to 3.9 in 1952 (Fig. 14).

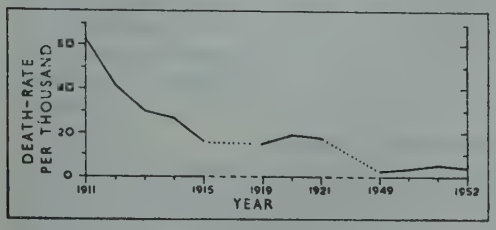

Fig. 14. Death-Rate of Rubber Estate Labourers in Malaya, 1911 to 1952. The figures for 1949-52 refer to conditions in the Federation of Malaya as a whole; the other figures refer to conditions in the former Federated Malay States only.

Source: H.M.O. Lester *Federation of Malaya, Annual Report of the Medical Department, 1952* (Kuala Lumpur, 1954), p.14.

Although there have been recurring peaks of heavy malarial infection among the estate population the general picture has been one of slow but steady decline. By 1935 protection in the main towns and on the large estates of the Straits Settlements was as complete as human effort could make it.[3] The same was also true in the Federated Malay States, and the developed parts of the Unfederated Malay States.[4]

Malaria Control In The Rural Areas. While anti-malaria work was going on apace in the towns and estates, little was being done in the peasant rural areas. Vickers and Strahan, commenting on malaria prevention in general in Malaya, stated in 1937, 'By far the greatest section of the populace, the great indigenous rural population, is almost untouched'.[5] The problems of control amongst a population scattered widely over the country and often separated by intervening stretches of malarial swamp or jungle were, and still are, overwhelming. To be effective such control must be both thorough and continuous. The greatest obstacle was insufficient funds. Up to the present day 'the task of extending anti-malarial work to the small villages and kampongs in any substantial measure is beyond the public purse.'[6] Apart from the question of funds, the ecological relations of the vectors to the peasant environment had also been neglected until 1940, and not very seriously studied until recent years. The few and sporadic experimental efforts at kampong malaria control were neither representative nor extensive enough to build up a store of practical knowledge comparable to that gathered for urban and estate malaria.[7]

Though the conservative peasants have so far not objected actively to such governmental health measures as have been tried, a programme of control on the

1. Field and Reid, op. cit., p.164.
2. Howard, op. cit., pp.1-10.
3. *Annual Report on the Social and Economic Progress of the People of the Straits Settlements, 1935* (London, 1936), p.17.
4. *Malayan Union, Annual Report of the Medical Department, 1947* (Kuala Lumpur, 1948), pp.18-19.
5. Vickers and Strahan, op. cit., p.30.
6. S.W. Jones, *Public Administration in Malaya* (Oxford, 1953), p.47.
7. T. Wilson, 'The Control of Rural Malaria', *I.M.R. Bulletin No. 2, 1939* (Kuala Lumpur, 1940), pp.18-22.

scale necessary for rural malaria might conflict with local traditions and perhaps with methods of agriculture, and therefore arouse, if not hostility, at least non co-operation. Malaria control measures cannot be successful until they are understood, supported and ultimately carried out by the peasants themselves. At any rate it is not possible to eradicate all anopheline vectors in a rural setting as has been done in some towns. The most that could be done is a reduction of their numbers below the level necessary for the rapid transmission of malaria. The social and educational problem is as serious as the technical and financial. It is difficult for a population which has never known any state other than being malaria-infected, and who have accepted and adjusted their economy and attitudes to it, to conceive of a mosquito- and disease-free condition.

The people in many of the long established kampongs have reached a state of endemic malaria equilibrium, that is, though malaria is present at all times it does not greatly disturb the rhythm of their every-day life.[1] To reach this state the population has had to pass through a cycle of infection consisting of several phases of endemicity. The pioneer peasant community when first exposed to the malaria parasite suffers very heavy rates of infection. This has been termed the epidemic phase. The second phase, the hyperendemic, prevails when the settlers have become saturated with the disease, but are beginning to grow tolerant towards it. As cultivation conditions become stabilized and the degree of immunity of the community increases, the disease settles down to a final moderate level of endemicity. This pattern has been noted among the communities in Negri Sembilan especially studied by officers of the Institute for Medical Research. It was also found that the degree of immunity was never complete, and fever attacked people of all ages. These attacks, however, were seldom severe, except in the lower age groups, and most children were found to have been infected before they were 5 years old. The prevalence of the disease lowered the physical constitution of the communities.

Within a community several stages of malaria may exist, depending on the degree of immunity of the people, the state of advancement of cultivation, the topography and the ecological surroundings of the settlement determining the species of vectors present. Variations in any of these factors tend to shift the balance one way or another. For example, the clearing of new ground for agricultural extension is always likely to be followed by renewed attacks of fever. Or again, the uprooting of old rubber trees and the replanting of seedlings (which means a sudden break of foliage cover) can bring along with it a minor epidemic. This is consequently a fact of vital significance to the planning of a programme of rural development, which envisages the bringing in of new areas into cultivation as well as the improvement of old.

The lack of popular attention to malaria in rural Malaya in the past does not mean that the disease there is of less importance than in towns and estates, where the greatest achievements in its control have been made and where there has been the widest publicity. Apart from the lack of funds and skilled personnel, two main reasons may be cited for the lack of attention in rural areas. Firstly, the disease, though it weakens the physique of the people, is not as deadly to a population of acquired immunity as it is to an immigrant population. Such deaths as do occur are seldom on a scale similar to that of an epidemic in the towns. Secondly, the peasants that do contract the disease rarely receive treatment in a hospital,[2] and therefore escape enumeration in official statistics. Such surveys as were made in pre-war and in recent years, however, all point to the prevalence

1. Field and Reid, op. cit., pp.146-7.
2. *Annual Report of the Malaria Advisory Board, 1955* (Kuala Lumpur, 1956), p.1.

and seriousness of malaria in the Malay kampongs. For example, the careful enquiry into the malaria problem in Kedah by Vickers and Strahan revealed that 46 per cent of the total deaths in 1936 was due to malaria and other fevers, and most of these deaths occurred among the padi-planters of south and central Kedah.[1] An intensive enquiry into malaria in coastal and inland kampongs in Negri Sembilan and Selangor conducted by the Institute for Medical Research between 1936 and 1940 showed high rates of infection among the population. In Sijangkang, a coastal kampong in Selangor, the average infection rate amongst children in a Malay school over the years 1936, 1939 and 1940 was 35 per cent and the spleen rate was 60 per cent. Jeram, another coastal kampong, showed a parasitic rate of 51 per cent and a spleen rate of 70 per cent. A house to house survey of the inland valley of Sungei Inas revealed a parasitic rate of 22 per cent for all ages of the population. In the Ulu Jempol Valley of Negri Sembilan, the average parasitic rates of children in different kampongs were 14 to 34 per cent and the spleen rates 20 to 50 per cent, while in another valley, Kampong Lenggeng, the figures were 50 per cent and 64 per cent respectively.[2]

Pre-war efforts at relieving rural malaria, in view of the large areas and the dispersed population, were based on curative rather than preventive measures. Even then, efforts were hampered considerably by the lack of skilled medical staff, by lack of funds and by the relative inaccessibility of the peasant areas. Governmental help was given mainly through travelling dispensaries. The earlier motor dispensaries could serve only those people living in kampongs peripheral to the land transport lines. Later, motorized boats were used for work amongst the riverine population, but it was a slow and arduous operation. For example, a motor-boat dispensary serving the kampongs along the Pahang River in the non-flood season would take a month or so to reach the more accessible areas. In 1920 there were only eighteen rural dispensaries, but the distribution of quinine was organized through police stations, post-offices, and schools. The help of the local headmen was also enlisted.[3] But while these curative measures helped to lessen the sick and death rates, the infection rates were scarcely affected because the chances of reinfection were great and the vectors were not removed. The scattered population, the year-round prevalence of malaria, and the consequent liability to reinfection at any time rendered the continuous administration of drugs necessary if it was to be effective. Not only was such a procedure costly, but there were no means of ensuring its conscientious application, there being neither the facilities nor the guarantee of co-operation by the rural population.

Attention was turned to finding better and less costly means of rural malaria control which could at the same time fulfil the following conditions: (1) be cheap; (2) be of a simple and easily understood yet semi-permanent character which would not need constant attention; and (3) be carried out and maintained as far as possible by the local inhabitants themselves. Methods were evolved which came to be known as 'naturalistic control.' The principles on which these are based are described as follows: 'The epidemiology of malaria is intimately connected with the adjustments and responses of the malaria-carrying mosquitoes to their environment. The natural factors which determine whether or not water is malariogenic are numerous and often complicated since they are dependent upon physical, chemical and biological conditions. The deliberate manipulation by

1. Vickers and Strahan, op. cit., p.28.
2. *Federation of Malaya, Annual Report of the I.M.R., 1940,* pp.4-5, 63-7.
3. *Federated Malay States, Annual Reports of the Medical Department* for the years 1919, 1920 and 1921.

man of one or more of these natural factors so as to prevent mosquito breeding, to destroy larvae, or even to deviate adult mosquitoes from man to animals has come to be known as Naturalistic Control."[1]

In Malaya experiments were conducted on 'natural' methods of control for coastal, lowland and foothill malaria, each experiment being modified to suit local conditions and the different modes of peasant land-use in these areas. A large proportion of coastal malaria was caused by human interference with ecological conditions, such as mangrove cutting, the clearing of vegetation for new padi, rubber, oil-palm, coconut holdings and the like. The most effective method of controlling coastal malaria was through the use of tidal gates and sea bunds to exclude sea water, but these were expensive and their use was limited to coastal towns such as Malacca, and to large agricultural undertakings such as the Krian Irrigation Scheme and private estates. These control measures were concentrated on the more developed west coast. The east coast peasant areas remained unrelieved. However, the brackish water and tidal zone on the east has been little developed by the peasants, the tidal swamps, for instance, have not been converted into fishponds as in Java. The fishponds of Java present good locations for *A. sundaicus* breeding, and the tidal areas of Java are among the most malarious parts of the island.[2] It is evident that any plan for increasing peasant fish production in Malaya through the use of salt-water ponds will have to be coupled with a way of solving the mosquito problem.

Lowland malaria, spread mainly by *A. umbrosus*, is associated with wet-padi cultivation, but the peasants engaged in this form of agriculture are relatively free from the worst ravages of the disease. Watson discovered that the absence of mosquitoes in the flat padi-fields of Krian was due to the unfavourable breeding conditions caused by rotting vegetation in the standing water. One of the traditional peasant practices in padi cultivation was to incorporate cut grass, padi straws and other vegetable waste matter in the flooded fields prior to planting. Another was to feed the fish in padi-field ponds on chopped grass, cow dung and other excreta. Both these practices helped to make the water unsuitable for mosquito larvae. But *A. umbrosus*, and other lowland shade-loving anophelines, continued to breed along the grassy edges of ditches and irrigation canals. Two measures of 'naturalistic control' were adopted here to prevent breeding. The first was to introduce larvae-eating fish into the water. This was done in Krian in 1915, and the idea soon spread northwards to Kedah and southwards to Johore. This method of control has the advantage of getting rid of larvae and at the same time providing an extra source of protein and income to the peasants in the form of fish. The second method was called 'fascining', whereby quantities of dead palm leaves, coconut husks and other vegetable matter were packed into the ditches to discourage breeding by contaminating the water.[4]

Foothill malaria presented the most difficult problems. Various experiments were tried, such as sluicing or flushing with a strong jet of water. But this entailed the construction of dams, and, in a country with heavy rainfall and innumerable small streams, the amount of constructional work involved made this method impractical. Fascine drainage, whereby a layer of sticks was laid in the

1. League of Nations, *Report of the Inter-Governmental Conference of Far Eastern Countries on Rural Hygiene*, p.92.
2. W.J. Stoker and J. Kuipers, 'Malaria Control in Salt-Water Fish-Ponds in Java'. *Proceedings of the Fourth International Congresses on Tropical Medicine and Malaria*, Vol. I, pp.881-3; also W.V. King, 'Man-made Malaria', ibid., p.862.
3. C.N. Maxwell, 'Malaria Prevention and Farming', *I.M.R., Bulletin No. 3, 1923* (Kuala Lumpur, 1923), pp.2-3.
4. *Federation of Malaya, Annual Report of the I.M.R., 1940*, pp.76-7.

seepage drains about six inches above the water level and covered with 'lalang' grass to prevent the mosquitoes from getting at the water, proved useful for control in the seepage zones. But the layer of sticks and grass lasted only six months so that this method did not meet the need for permanency, and it was also unsuitable for use in streams.[1] Larvae-eating fish could not be introduced into the small bodies of flowing water in which *maculatus* bred.[2]

None of the methods was satisfactory, and the only alternative was to let the infection take its course, and to depend on the reclosing of the gaps in the forest cover by planted tree crops reducing the number of exposed water surfaces. Unfortunately, Malay settlements such as those in the Negri Sembilan hill and valley landscape follow a linear pattern along the break of slope (which is also the seepage zone), and the lighter shade-cover along this zone, where the flat padi-fields meet the tree-covered kampongs, encourages heavy *maculatus* breeding (Fig. 13).

Up to 1939 none of the anti-malarial experiments proved to be practical for large-scale application to rural areas, and as Field has said, 'It cannot be claimed . . . that any of these measures were ever widely employed in Malaya for the control of rural malaria.'[3] Strahan, reviewing the situation in 1946, considered that the control methods in use elsewhere were not applicable to the rural areas because they required too much supervision, repair and replacement, and could not be applied extensively or rapidly enough to be effective.[4]

Further investigations were started after the war. In 1948, the Institute for Medical Research, aided by Colonial Development and Welfare funds, made a fresh line of approach based on the war-time discoveries of powerful insecticides, notably DDT and BHC (Gammaxane). The aim was to discover the effectiveness of residual house spraying of these insecticides on the adult mosquitoes. A four-year trial, initiated in 1948, was made in the highly malarious kampongs of Negri Sembilan. The conclusion at the end of the trial was that where malaria in isolated kampongs was transmitted by *A. maculatus,* a weekly distribution of a prophylactic drug (such as Proguanil) and a twice-yearly spraying of the houses with DDT or BHC will reduce the infection and disease rate. It was also discovered that although DDT and BHC were both effective against *A. maculatus,* they did not retain their effect for longer than six months. Even when it was first applied DDT did not kill more than 80 to 90 per cent of the susceptible species. Although BHC obtained complete kills, it lost its effect faster than DDT. Both insecticides were effective for only three months against *A. sundaicus* (the vector of coastal malaria), *A. barbirostris* (the main vector in the padi-fields of Kedah), and species of *Mansonia* (the main vectors of filariasis), while many species of *Culex,* especially *C. fatigans,* were hardly affected.[5] Recent experiments point to a growing immunity of mosquitoes to insecticides.[6]

1. G. Waugh-Scott, 'Fascine Drainage in Mosquito Control', *Malayan Med. Jrn.,* Vol. IX, 1934, pp.65-6.
2. Field and Reid, op. cit., pp.166-7.
3. Ibid., p.167.
4. *Malayan Union, Annual Report of the Medical Department 1947,* pp.18-19.
5. J.F.B. Edeson and R.H. Wharton, 'Some Aspects of Malaria Research in Rural Malaya', *Malaya,* 1954, pp.151-3; *Federation of Malaya, Annual Report of the I.M.R., 1952* (Kuala Lumpur, 1954), pp.1, 33. Also, *Annual Report of the Malaria Advisory Board, 1954* (Kuala Lumpur, 1955), p.4.
6. As emphasized by the World Health Organization the development of insecticide-resistant strains of anophelines among populations rendered non-immune by temporary release from malaria could start serious epidemics. Reported in the *Sunday Gazette* (Penang) 10th April 1955; see also the *Singapore Standard,* 20th September 1955; and the *Manchester Guardian,* 7th April, 1956.

Thus whilst over the Malay Peninsula as a whole malaria has been reduced from being the greatest killer to the least significant cause of death in terms of numbers (Table 19), and 2.2 million people were reported to be living in protected areas in 1954,[1] the downward trend relates only to the urban and estate population.

TABLE 19: PRINCIPAL CAUSES OF DEATH IN THE FEDERATION OF MALAYA, 1954 AND 1955

CAUSE	1954	1955
FEVER OF UNKNOWN ORIGIN	19,600	18,700
INFANTILE CONVULSIONS	11,300	8,800
MALARIA	900	800
PULMONARY TUBERCULOSIS	1,600	1,500
PNEUMONIAS	2,400	1,900
VIOLENCE	2,800	2,500
DIARRHOEA AND ENTERITIS	2,200	2,200
SENILITY	10,600	11,600

Source: *Federation of Malaya, Report of the Medical Department, 1955* (Kuala Lumpur, 1957), p. 10.

The majority of the rural population, except the resettled Chinese squatters, remain exposed to the disease, and as Field states, 'Discussion of the post-war decline of malaria in Malaya must ... exclude the peasantry of the kampongs. The work of the Institute since the war among the Malay padi farmers in Negri Sembilan gives no grounds for thinking that the endemic reservoir in scattered and remote rural communities is less than in the years before the war.'[2]

The history of economic development in Malaya has illustrated the fact that the disturbance of the ecological environment of anopheline vectors, as occurred with the large scale clearing of forest for tin-mining, rubber cultivation, fuel, and for the building of roads and railways, has always been followed by a sharp intense wave of malarial infection, which either settled down to a steady but high rate, or fell to a low level of incidence where control measures were thoroughly enforced.[3] In brief, the process of pioneering, which is a collateral of rural development, in a hyperendemic malarial area like Malaya is invariably a precarious affair from the disease standpoint, unless expensive control measures are undertaken simultaneously and kept up. Such measures can only be realized in Malaya by organizations having substantial funds at their command, such as the Government or large commercial enterprises. As far as the peasant is concerned, he is not capable, singly or even collectively, of providing for these measures.

FILARIASIS IN RURAL MALAYA

Filariasis, a disease whose characteristic manifestation is a swelling of the limbs (a condition known as elephantiasis), bears many similarities to malaria. Both are caused by microscopic parasites (in the case of filariasis, by a worm) which spend part of their life-cycle in an intermediate host—the mosquito. The geographical distribution of both is thus determined by the distribution of the mosquito vectors. Though filariasis is rarely fatal, the disease is at times much more of a hindrance to the peasant population than malaria, since the infected

1. *Federation of Malaya, Weekly News Summary* (Kuala Lumpur, 25th December, 1954), p.5.
2. Field and Reid, op. cit., p.171.
3. For an account of the relationship between economic development and malaria in Malaya, see *Annual Report of the Malaria Advisory Board, 1955*, pp.1-7.

person at a later stage of the disease is unable to do any work and becomes a burden to the family and community.

The world distribution of filariasis is determined largely by the physical-geographical factors which affect the life-cycle of both the parasite and the mosquito vector. High temperatures are necessary to the survival of both, and filarial elephantiasis as an indigenous disease does not occur polewards of latitude 35°N or latitude 30°S. High humidity is also necessary to their existence, and the principal endemic areas of the tropical world are in low-lying swampy regions, in flat and frequently inundated locations such as river deltas, lakes, depressions, and other sites on or near water bodies.[1] Filarial diseases are therefore common in all tropical countries, especially in the equatorial tropics with their high temperatures and heavy rainfall. Their prevalence is conditioned by local variations in climate, mosquito distribution and in the distribution of the human hosts.[2]

The parasite which causes filariasis in most areas is *Wucheria bancrofti.* In the Malay Peninsula endemic filariasis is caused by another filaria of the same genus—*W. malayi,* though *W. bancrofti* is also present.[3]

The geography of filariasis in Malaya shows a marked resemblance to that of malaria, with the additional difference that it is more a 'rural' disease than the latter. Because of this and because it is a cause of disability rather than of death, endemic filariasis was not the subject of serious study until 1932, when a survey of the disease in Province Wellesley revealed that the infection rate amongst the coastal peoples was as high as 35 per cent. The region surveyed was mainly under wet-padi, with permatangs running parallel to the coast and dividing the fields. It was found that all the kampongs on the coast were free from infection, whilst the inland kampongs were all heavily infected. This was attributed to sea breezes keeping the coast, but not the inland areas, free from mosquitoes. The disease could be traced back seventy-five years, and in the opinion of the villagers, it was becoming increasingly common. It was suggested that the spread might be due to the seasonal migration of people to Kedah for padi cultivation.[4]

By 1936 the Institute for Medical Research had instituted a series of other surveys, and the main endemic areas of the Peninsula have been mapped, but it was not until after the war that the high rates of infection among the peasants living in the endemic areas became apparent.[5] From these researches a definite relationship was established between the distribution of the urban and rural population of Malaya and the distribution of the vectors which determine the prevalence of the disease. It is now known that the main vector of the *W. bancrofti* form of filariasis is the mosquito *Culex fatigans,* which is essentially a domestic mosquito found only in urban areas where sanitary arrangements are inadequate. But this form of filariasis occurs only sporadically and is not endemic anywhere in Malaya. This is because of the highly developed state of anti-mosquito work in the towns. On the other hand, the form of filariasis due to *W. malayi* is much more widespread. The main vectors are lowland swamp mosquitoes of the genus *Mansonia.* The highly endemic regions in the Peninsula are therefore the lower

1. Clemow, op. cit., p.608.
2. See the world map of the distribution of filariasis in J.M. May's 'Map of the World Distribution of Helminthiases', *Geographical Review,* Vol. XLII, No. 1, 1952, pp.98-101.
3. T. Wilson and J.A. Reid, 'Filariasis', *The Institute for Medical Research, 1900 to 1950* (Kuala Lumpur, 1951), pp.210-11.
4. J.H. Strahan and V.H. Norris, 'Notes on the Incidence of Filariasis in Procince Wellesley North', *Malayan Med. Jrn.,* Vol. IX, 1934, pp.44-7.
5. *Federation of Malaya, Annual Report of the I.M.R.* for the years 1936 to 1939, passim.

reaches of the main rivers where swampy conditions prevail—the Perak River, the River Bernam and the Pahang River, as well as some coastal stretches in Kedah and Province Wellesley (Fig. 15).

The disease is not as prevalent as malaria, but it exists in those localities where the *Mansonia* mosquitoes have their habitat. Unlike malaria, it appears to be absent from the well drained upland regions.[1] The *Mansonia* species which transmit the infection are *M. annulatus, M. annulifera, M. longipalpis, M. uniformis* and *M. indiana.* Since the adult parasite *W. malayi* has a life of fifteen years, an infected person will remain a source of danger to others for that period. The fact that the larvae of *Mansonia* obtain their air supply from the submerged portions of water plants further limits the distribution of the vectors to those places where such plants are plentiful, namely the freshwater swamps, abandoned padi-fields in the course of reverting to swamp, and partially cultivated padi-fields.[2]

In the Province Wellesley endemic region, the earlier evidence indicated *M. indiana* as the chief vector, but later investigations revealed that species of anophelines (*A. barbirostris* and *A. hyrcanus*) were more important as vectors. In Kedah, on the other hand, no anophelines were found, but all species of *Mansonia* transmitted the parasite.[3] The vectors in both Kedah and Province Wellesley breed mainly in open or lightly shaded ponds, wells and ditches with water from one to four feet deep covered with aquatic plants, and in patches of uncleared swamp.[4]

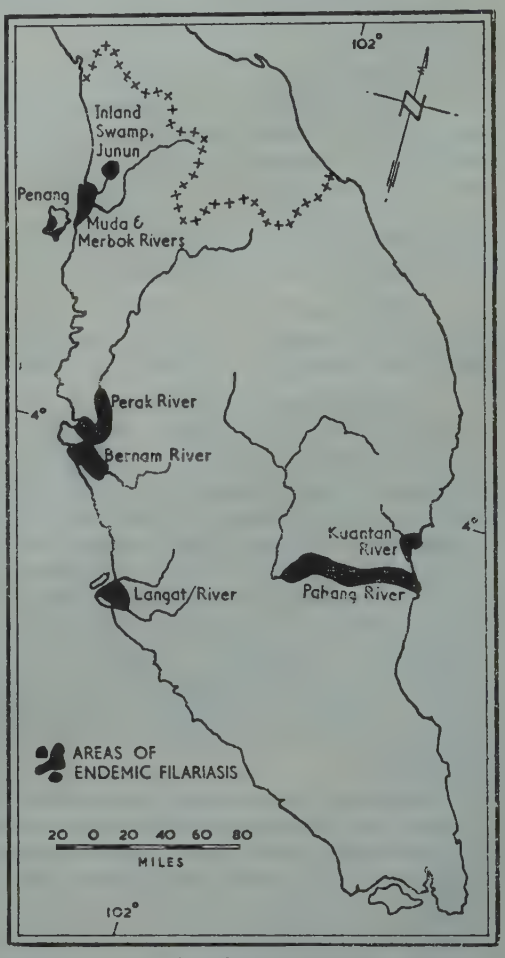

Fig. 15. Areas of Endemic Filariasis in Malaya, 1949.
Based on T. Wilson and J.A. Reid, 'Filariasis', in *The Institute for Medical Research, 1900 to 1950,* Fig. 59, p.222.

1. The latest evidence, however, points to the likelihood that some of the uplands may be endemic because of the records of filariasis among hill Aborigines, and the presence of considerable numbers of *Aedes (Finlaya) chrysolineatus Theo.* in steep, forested hill-sides. These mosquitoes are also capable of carrying the parasite. *Federation of Malaya, Annual Report of the I.M.R., 1953,* p.64.
2. The plants most favoured are *Pistia stratiotes* (Malay: kiambang), *Eichornia crassipes* or water-hyacinth (kaladi ayer), *Ipomea reptans* (kangkong), as well as swamp grass and other aquatic plants. J. Orde Poynton and E.P. Hodgkin, 'Endemic Filariasis in the Federated Malay States', *I.M.R., Bulletin, No. 1, of 1938* (Kuala Lumpur, 1938) App. 1, pp.53-4.
3. *Federation of Malaya, Annual Report of the I.M.R., 1952,* p.50.
4. *Federation of Malaya, Annual Report of the I.M.R., 1950* (Kuala Lumpur, 1951), p.34.

The chief vectors in the endemic areas of the lower deltaic plains of the Perak, Bernam and Pahang Rivers are *M. longipalpis* and *M. uniformis*. Unlike those in Kedah and Province Wellesley these prefer jungle-covered freshwater swamp for breeding purposes.[1]

In all the endemic areas the rates and incidence of infection were very high. In an examination of affected kampongs in Kedah, Vickers and Strahan found an infestation rate of 36 per cent among the people.[2] Other surveys made by Poynton and Hodgkin showed endemicity rates of up to 50 per cent.[3] Post-war examinations have again revealed the prevalence of the infection. A blood and clinical examination of 619 persons in the Pahang Tua area showed that 315 of them (51 per cent) either carried the parasite in their blood, or had elephantiasis, or both.[4] Table 20 summarises the results of post-war surveys by the Institute for Medical Research in some of the endemic areas. Out of the total of 1,408 persons examined, 643 or nearly 46 per cent were infected.

TABLE 20: THE EXTENT OF FILARIAL INFECTION IN MALAYA, 1947-50

SEX AND AGE	TOTAL NUMBER EXAMINED	NUMBER WITH BLOOD INFECTIONS	NUMBER WITH ELEPHANTIASIS	NUMBER WITH BOTH
MALES OVER 10 YEARS	533	233	58	4
FEMALES OVER 10 YEARS	492	162	36	2
CHILDREN, 10 YEARS AND UNDER	383	146	1	1
TOTAL	1,408	541	95	7

Source: Wilson and Reid, op. cit., p. 224.

Control Measures. Before the war there were no attempts to control the disease in the rural areas on the lines of the anti-malarial measures. In the towns, however, where *Culex fatigans* is the main vector, the breeding places of this mosquito were eleminated simultaneously with those of the anophelines. In the rural areas, oiling, effective against anophelines, was found to be useless against *Mansonia* because of the peculiar breathing habits of the larvae. No effective drug against the disease was available. The only method of treatment was by surgery, but this was an impractical course for a population living in remote districts, unable to afford the costs, and naturally reluctant to submit to the knife.

It was discovered accidentally that relocation of the infected population would prevent further spread of the disease. This however, is no solution to the problem because of the impracticability of moving large numbers of people from otherwise attractive agricultural sites, even granting that such movement could be achieved without social dislocation. Since the flight range of the mosquito vectors is still unknown, resettlement of population too near the endemic site may not prevent re-infection by mosquitoes flying towards the new site to feed.

In 1947 the Drainage and Irrigation Department in conjunction with the Institute for Medical Research undertook an experiment at controlling filariasis at Kampong Sungei Kedak in Province Wellesley. Here the main breeding places were among the water hyacinths growing in the open spaces in the freshwater

1. Wilson and Reid, op. cit., pp.214-15.
2. Vickers and Strahan, op. cit., pp.50-2.
3. Poynton and Hodgkin, op. cit., pp.37-8.
4. *Federation of Malaya, Annual Report of the I.M.R., 1950,* p.33.

swamps. The Drainage and Irrigation Department cleared away the beds of water hyacinth, and the results proved encouraging. The number of infected mosquitoes caught per night dropped from ninety-eight in 1947 to eight in 1948, but rose again the eighteen in 1949.[1] However, because of the necessity for periodic and regular clearing (the hyacinth is a persistent and fast-growing weed) the experiment was not extended to other areas, and no final conclusion was reached.

In the coastal endemic areas of Province Wellesley and Penang, both *Mansonia* and anopheline mosquitoes transmit filariasis, so that control of the disease would have to include the destruction of the different breeding habitats of these vectors.[2] In Kedah, *Mansonia* breed in small fish-ponds spread over many hundreds of acres of padi-fields,[3] and even if weeding of the aquatic plants was possible, such a procedure would have adverse effects on the peasants' fish supply. The situation in the major endemic regions of the Perak, Bernam and Pahang Rivers remains the most serious as the vast extent of freshwater swamps in which *M. longipalpis* and *M. uniformis* breed makes it practically impossible to reduce transmission of infection by anti-larval methods. Control measures in newly developed padi-land would have to be extended for some distance beyond the boundaries of the fields to prevent the mosquitoes from flying in to feed at night and returning to the peripheral swamps to shelter and multiply.

The two lines of attack against filariasis today are, first, curative treatment with a newly discovered drug, and second, anti-mosquito spraying with insecticides. Before the war there were no known cures for filariasis, but in 1947 a promising drug—Hetrazan—gave new hopes. However, when tried under actual conditions it did not justify expectations.[4] The drug killed the filarial parasite in the blood, and was potent for a year, but it induced unforeseen febrile reactions in the patients and had no effect on infected persons who had already developed elephantiasis.[5] The possibilities of residual spraying with DDT and other insecticides have not been explored, but experiments in connection with anti-malarial measures have shown that both DDT and BHC retained their lethal effects against all species of *Mansonia* for only three months.[6]

In certain respects filariasis has proved to be even more of a handicap to agricultural development in rural areas than malaria. Apart from the recurrent attacks of fever which sap the vitality of the infected person, the final stage of the disease brings on an enormous swelling of the legs and other parts of the body. This latter condition tends to be more prevalent among adults (Table 20) and to increase in severity with age. The early age at which this stage can come about, the increased deformity through the years, and even the non-fatal character of the disease, all combine to reduce the infected person to being a heavy burden to his family for the rest of his life. He also becomes a reservoir of further infection to the community. The disease tends to generate a vicious circle of lowered agricultural production because of lack of adult labour, leading to lowered standards of nutrition, and then to a reduction in vitality and lessened

1. *Federation of Malaya, Annual Report of the I.M.R., 1949*, pp.28-9.
2. *Federation of Malaya, Annual Report of the I.M.R., 1952*, p.50; *Federation of Malaya, Annual Report of the I.M.R., 1953*, p.63.
3. *Federation of Malaya, Annual Report of the I.M.R., 1952*, p.50.
4. J.W. Field, 'The Institute over Fifty Years', *The Institute for Medical Research 1900 to 1950* (Kuala Lumpur, 1951), pp.84, 86.
5. Wilson and Reid, op. cit., p.225.
6. *Federation of Malaya, Annual Report of the I.M.R., 1952*, p.1.

resistance to infection. Because natural immunity cannot be acquired against filariasis as it can be against malaria, the disease tends to perpetuate itself and even to increase with time.[1]

As with malaria, there is a correlation between endemic filariasis and the economic occupations of the affected population as well as the racial incidence. In the main endemic regions of Perak, Selangor and Pahang, the characteristic mode of living of the Malays is based on padi cultivation. The necessity for choosing low-lying swampy sites in which to grow the crop means that the likelihood of being bitten by swamp mosquitoes is increased. Poynton and Hodgkin recorded that of 983 cases of elephantiasis found in endemic areas, 819 (83 per cent) were among Malays, 159 (16 per cent) among Indians, and only 5 (1 per cent) among Chinese.[2] The main reason for its prevalence among the Malays lies in the nature of their economic occupations which are padi-planting and fishing in or near swamps, collecting nipah leaves for thatch, and working generally in a wet environment. Indian and Chinese shopkeepers who lived in highly endemic areas have also been found to be infected.[3]

Filariasis remains a serious problem in rural Malaya. There are few immediate prospects of control or relief. The prevalence of vectors in the deltaic plains of the large rivers emphasizes the need for adequate health measures in the opening up and development of new padi-lands.

ANKYLOSTOMIASIS, YAWS, INTESTINAL AND RESPIRATORY DISEASES.

Ankylostomiasis. Ubiquitous in tropical areas is the group of diseases caused by helminth parasites. Their distribution is directly related to physical conditions of climate and soil. The life-cycle consists of two distinct phases. The first when the adults are lodged in the body tissues of the host where they produce enormous quantities of eggs which can only develop outside the host, and the second when, after their discharge from the host, the young parasites undergo a period of development before they are capable of taking up adult existence. It is during this period of development that they are extremely sensitive to meteorological fluctuations of light, humidity and temperature.[4]

Of the group of helminthic diseases, the most widespread is ankylostomiasis or hookworm disease. The larvae of the parasitic worm undergoes its development in the soil, and the most important factors in its development and existence are temperature and soil moisture. The optimum range of atmospheric temperatures for larvae development is between 77°F and 86°F. Temperatures of less than 46°F are fatal to them.[5] The hyperendemic incidence of the disease is thus restricted to the tropics. A second requirement for survival is the presence of adequate soil moisture. The larvae can only live if surrounded by a film of water.[6] The prevalence of the parasites is therefore also determined by the amount and

1. Poynton and Hodgkin, op. cit., p.14.
2. Ibid., p.12.
3. Wilson and Reid, op. cit., p.223.
4. R.T. Leiper, 'The Influence of Meteorological Conditions on the Spread of Parasitic Worms', *Report of the Agricultural Meteorological Conference, 1928* (London, 1928), pp.79-82.
5. H.P. Carr, *Hookworm Disease* (Hagerstown, Maryland, 1949), p.98.
6. Ibid.; also A.S. Chandler, *Hookworm Disease* (New York, 1929), pp.16, 26, 52, 165-7. The parasite which causes the helminthic disease called 'kala-azar' in Asia and leishmaniasis in the Americas has almost exactly the same climatic and soil requirements. See J.M. May, 'World Map of the Distribution of Leishmaniasis' *Geographical Review,* Vol. XLIV, No. 4, 1954, pp.583-4.

incidence of rainfall, as well as by the nature of the soil (whether permeable or impermeable). Localities with less than forty inches of annual rainfall are not likely to have heavy infestation. An annual rainfall of sixty inches or more is sufficient to maintain heavy infestation.

Low lying swampy flats in regions of heavy, evenly distributed rain and high annual temperatures are ideal locations for the parasites. The world maps of hookworm disease show that although conditions favourable to the maintenance of hookworm endemicity occur in a belt between latitudes 36°S and 30°N, the areas of very high endemicity are:— the equatorial and monsoonal countries in South and South-east Asia; a broad equatorial belt in Africa from the west coast to the highlands of East Africa, with an extension along West Africa and the coastal strip of East Africa; and in the Americas, the hot wet areas southwards from Florida to Central America, the West Indies, the Amazon Valley, and the coast of Brazil.[1]

The incidence of hookworm and other helminthic infections among the tropical peoples is very high. In the Gambia almost every inhabitant harbours intestinal parasites of one kind or another, hookworm being most common in Bathurst, askaris in the lower reaches of the river, and tape worm in the upper reaches.[2] Parasitic complaints, chiefly hookworm are almost universal in Sierra Leone, producing debility and lowering resistance to other diseases.[3] In Nigeria, a survey of trader and peasant groups revealed the following incidence of hookworm:— among Wari traders 73 per cent; Sorabemi fishermen 96 per cent; Illu farmers 95 per cent; Bida farmers 95 per cent; Kontagora farmers 57 per cent and Zuru farmers 65 per cent.[4] The high rate of intestinal infestations was considered to be more important than malnutrition in producing anaemia. In Uganda, medical officers reported widespread prevalence of parasitic diseases, especially hookworm, with a rate of incidence in certain districts of nearly 100 per cent.[5] In Kenya almost every peasant was infested with some type of helminthic worm.[6]

The same general picture is encountered in the Asian tropics. In India forty-five million people were estimated to be affected by hookworm, with nearly a 100 per cent incidence amongst the rural population of Madras. The disease was responsible for a 25 to 30 per cent reduction in working efficiency.[7] In Indo-China the infestation rate varied from an average of 20 per cent in South Annam to 50 per cent and over in the Tonkin Delta.[8] The large percentage of infected people living in the hookworm zone and the highly chronic, debilitating and frequently fatal effects of the disease have made some refer to it as second only to malaria in the harm it does.

1. May, 'Map of the World Distribution of Helminthiasis', pp.98-101.
2. *Colony of the Gambia, Annual Medical and Sanitary Report for the Year 1938* (Bathurst, 1939), p.9.
3. *Sierra Leone, Report of Census for the Year 1931* (Freetown, 1931), p.15.
4. B.M. Nicol, 'The Nutrition of Nigerian Peasants, with Special Reference to the Effects of Deficiencies of the Vitamin B Complex, Vitamin A, and Animal Protein', *The British Journal of Nutrition* Vol. VI, 1952, Table 10, p.47.
5. *Uganda Protectorate, Annual Medical and Sanitary Report of the year ended 31st December, 1933* (Entebbe, 1934), p.33.
6. *The Colonial Problem* (Oxford, 1937), p.133.
7. 'Tropical Medicine', *Tropical Agriculture,* Vol. II, No. 1, 1925, p.2.
8. League of Nations, *Report of the Inter-Governmental Conference of Far-Eastern Countries on Rural Hygiene, Report of French Indo-China* (Geneva, 1937), p.115.

In Malaya, the Straits Settlements Rural Sanitation Campaign of 1926-28 first brought to light the extremely high incidence of hookworm and other helminthic infestations amongst the rural population. Some 27,000 people of all ages and every race in Malacca, Province Wellesley and Penang were examined. The results are shown in Table 21. A post-war survey on a smaller scale conducted by the Institute for Medical Research revealed a similar state of affairs. The rate of ankylostomiasis and ascariasis infection among smallholders was 80 per cent and 77 per cent respectively; among peasant fishermen 77 per cent and 87 per cent; and among wage-earning labourers 75 per cent and 56 per cent.[1]

TABLE 21: INCIDENCE OF HOOKWORM INFECTION IN MALACCA, PROVINCE WELLESLEY AND PENANG

RACE	NUMBER EXAMINED	NUMBER POSITIVE	PERCENTAGE INCIDENCE
MALAY	14,261	12,565	88
CHINESE	7,346	2,847	39
INDIAN	4,651	3,321	71
EURASIAN	853	283	33
EUROPEAN	136	30	22
OTHERS	149	66	44
ALL RACES	27,396	19,112	70

Source: P. F. Russell, 'Racial and Age-Group Incidence of Common Intestinal Helminths in the Straits Settlements', *Malayan Med. Jrn.*, Vol. IX, No. 1, 1934, Table 1, p. 18.

Physical conditions in the Malay Peninsula are ideal for larvae development—both high temperatures and high rainfall permit year-round infestation. But the actual penetration of the developed larva into the human tissues takes place through contact with animals or plants contaminated by excreta, or through walking barefooted on infested soil, or by drinking infected water. Infection is therefore a result of lack of sanitation and personal hygiene rather than of racial susceptibility as Table 21 might suggest.

The 88 per cent infestation among the Malay population is due to a number of factors. Firstly, the nature of their occupations, especially wet-padi cultivation which involves working in mud, is such that sooner or later it brings them into contact with larvae-infested soil or plants or water. Secondly, a large proportion of them go about barefooted. Malay children in the kampongs very seldom wear shoes, except perhaps when they go to school. Thirdly, there is a complete absence of facilities for the safe disposal of excreta, so that soil, plants and water are easily contaminated. Finally, the constantly damp atmosphere and damp soil around the typical kampong with its canopy of trees provide good development conditions for the larvae.

To a large degree the same situation prevails among Indian labourers working in estates, though sanitary conditions there are much better than in the kampongs. The practice of the Chinese farmers, especially the market-gardeners, of using human excreta for manure constitutes a danger to both the farmers and the consumers of their produce. The low percentages recorded for the other races

1. R.C. Burgess and Laidin B. Alang Musa, 'A Report on the State of Health, the Diet and the Economic Conditions of Groups of People in the Lower Income Levels in Malaya', *I.M.R. Report No. 13* (Kuala Lumpur, 1950), Table VII, p.18.

are a reflection not only of a higher standard of personal hygiene, but also of the much better sanitary facilities in the towns in which the majority of them live.

The effects of the disease can best be summed up in the words of the International Health Board, 'Hookworm disease, working so insidiously as frequently to escape the attention even of its victims, tends rather to debilitate the race by attacking the strong as well as the weak. The cumulative effects of the disease . . . handed down from generation to generation through long periods of time, are even more important than its contribution to the death roll among individuals.'[1] The leisurely habits of the Malays (and other tropical races) may also be partly due to the debilitating effects of hookworm and other helminthic infections.

Yaws. Of all the skin diseases, framboesia or 'yaws' is perhaps the most widespread in the tropics. It is a rural disease known by different local names—'paranghi' in Ceylon, 'patek' in Indonesia and 'puru' in Malaya. It has been estimated that out of a total population of seventy million in Indonesia, twelve million had yaws, and in some villages 75 per cent of the population were diseased.[2] It is also extremely prevalent among the Malays in Malaya. One early estimate put the degree of infection at six out of every ten.[3] In 1954 in Kelantan and Trengganu, 24,633 (or 26 per cent) out of the 94,831 people examined had yaws.[4]

A strictly tropical disease, yaws is caused by a micro-organism related to the syphilis micro-organism, and is extremely contagious. Small cuts, such as may occur when walking barefooted, or when harvesting padi with unprotected hands, are easily infected, but there is yet no general agreement as to what agents transmit the disease. Viswalingam believes that certain types of food (some kinds of salt fish and a certain type of rice in Malaya) are to be blamed,[5] while Field thinks that the vectors are the minute flies of the genus *Siphunculina* which swarm in Malay kampongs at certain seasons.[6] A puzzling feature of the disease is that it seems to be confined to the Malay kampongs. The rural Chinese living in wooden shacks and perhaps in as insanitary surroundings, and the Indian labourers in 'coolie lines', are seldom affected.

Like filariasis, yaws affects the Malay peasant population not through the death rate, but through the incapacity it brings on, through impairment of the general state of health and the greatly increased chances for contracting other diseases. The infected person cannot work efficiently, and in advanced cases, the painful scars and stiffened joints may entirely prevent work.

The disease was eliminated from the towns in the early part of this century, but the first systematic treatment of the kampong areas did not begin until 1920. At that time the disease could only be cured by ten injections of an arsenic compound, given at weekly intervals, and because of the chances of reinfection, and the long period of treatment (often the patients did not or could not attend

1. *Fourth Annual Report of the Rockefeller Foundation, International Health Board, 1917* (New York, 1918), p.24.
2. R. Calder, *Man Against the Jungle* (London, 1954), p.51.
3. A. Viswalingam, *The 'Puru' of Malaya: its Treatment and Eradication* (London, 1925), p.6.
4. *Federation of Malaya, Annual Report, 1954*, p.232.
5. Viswalingam, op. cit., p.4.
6. Field, op. cit., pp.292-5.

regularly because of work, weather, and disinclination), the campaign was not successful.[1] A new campaign was launched in 1954, and work was concentrated in Kelantan and Trengganu, both mainly Malay States. In the Besut and Pasir Puteh Districts of Trengganu and Kelantan the anti-yaws team visited 8,268 houses in the first few months and examined 26,709 people out of an estimated population of 36,589. The incidence of the disease there was nearly one in three. A single injection of penicillin cures the infection. But yaws can only be cured when treated early, and, because of its extremely contagious nature, every case within a region must be treated to lessen the possibilities of re-infection. The number of fixed and mobile clinics available today is sufficient to treat only half the number of cases, so that the more remote and inaccessible kampongs remain without the benefit of medical aid.[2]

Intestinal and Respiratory Diseases. Intestinal and respiratory diseases are common among the rural population of Malaya. Bowel diseases are common in those areas with a low standard of sanitation and without clean water supplies. The tropical climate and a starchy diet are also said to pave the way to intestinal infections.[3] In a constantly wet environment the problem of potable water is not so much a matter of actual scarcity as one of availability of non-contaminated sources. Thus in 1940 it was estimated that only 35 per cent of the population of the Malay States had access to unpolluted potable water.[4] Cholera is one of the major diseases spread by polluted water. It is also a disease of tropical areas, with high temperatures and humidities governing its endemicity. It used to decimate the Malays in historical times, but is of lesser importance today, being present in the Peninsula less than 10 per cent of the time (as compared with 90 per cent in endemic areas).[5] The disease, however, is still as fatal as it was at the turn of the century, the death rate was 82 per 100 in 1946.[6] In the Malay kampongs where the rivers are used for the disposal of excreta as well as for bathing, washing and drinking, there is always the likelihood of an epidemic outbreak such as that which occurred along the Perak River in 1927.[7]

The high incidence of enteric fever among the kampong Malays is also a direct consequence of using polluted river or well water for drinking.[8] For the same reasons 'bowel' diseases such as dysentery (both amoebic and bacillary types) and diarrhoea are common in the rural areas. Vickers and Strahan found these bowel diseases rife amongst the population in Kedah, and attributed the high infant mortality to infantile diarrhoea and gastro-intestinal trouble caused by drinking contaminated water.[9] Along the coasts of eastern Malaya (especially Trengganu) epidemic outbreaks of bacillary dysentery have occurred regularly among the fishermen, these outbreaks were ascribed to the large number of flies

1. Viswalingam, op. cit., pp.9-10; Field, op. cit., pp.292-4.
2. 'New Campaign to fight Yaws', *Malaya,* December, 1954, pp.679-81.
3. R.G. Stone, in *Climate and Man* (Washington, 1941) p.256.
4. J.S. Simmons and Others, *Global Epidemiology,* Vol. 1 (London, 1944), p.156. Also B.W. Hodder, 'Biogeographical Aspects of Settlement in Malaya', *M.J.T.G.,* Vol. 5, 1955, p.17.
5. J.M. May, 'Map of the World Distribution of Cholera', *Geographical Review,* Vol. XLI, No. 2, 1951, pp.272-3.
6. R. Green, 'Cholera', *The Institute for Medical Research, 1900 to 1950,* p.241.
7. E.H. Black and Others, 'The Control and Treatment of Cholera in the Federated Malay States', *I.M.R., Bulletin, No. 1 of 1928,* (Kuala Lumpur, 1928), pp.1-2.
8. W. Fletcher, 'Notes on the Epidemiology of Enteric Fevers in the Federated Malay States', *I.M.R., Bulletin, No. 4 of 1927* (Kuala Lumpur, 1927), pp.6-7.
9. Vickers and Strahan, op. cit., p.92.

that swarm during the fishing season. Further inland the outbreaks were due to unclean water rather than flies.[1]

Lack of statistics on the incidence of respiratory diseases in rural Malaya prevents a close assessment of the situation. Vickers and Strahan have observed that the Malays were most susceptible to influenza, and pneumonia was likely to be an important cause of mortality amongst the rural population of Kedah.[2] Tuberculosis, one of the most serious diseases in Malaya, was thought at one time to be primarily an 'urban' disease, but it has been shown to be common amongst east coast Malays. The seasonal and chronic state of malnutrition renders the poorer peasant population susceptible to infection. The high incidence of tuberculosis on the east coast has also been partly ascribed to the damp rain-bearing North-east Monsoon.[3]

RURAL DEVELOPMENT AND THE 'SILENT ZONES' OF DISEASE IN MALAYA

The dangers of interfering with the biogeographical environment in tropical areas have been demonstrated in the case of malaria in Malaya. The large scale clearing of jungle for rubber was followed by epidemic waves of malaria, which later settled down to a new state of equilibrium as conditions in the cultivated areas became stabilized and the population acquired some degree of immunity through exposure. In the large estates, where vigorous preventive and curative measures are pursued, a low endemicity of malaria prevails, but in the peasant areas where malaria is not controlled, the disease is now in a state of unstable equilibrium and epidemics are likely to occur at any time when conditions become favourable. Thus for example, the food shortage during the Japanese occupation compelled many people to fell jungle in order to grow food-crops. In many peasant areas this new disturbance of conditions started serious epidemic waves which killed a great number of people.[4]

The forested land in the Peninsula constitutes what May terms a 'silent zone of disease', that is, a zone in which all the elements of disease are present except man.[5] In the case of malaria, both the anopheline vectors and the plasmodium were present, the entry of man into the jungle completed the man-mosquito-parasite complex, and the result was epidemic outbreaks.

There is another 'silent zone' of disease in Malaya, connected with scrub-typhus and abandoned cultivated areas. Scrub-typhus is a four-factor complex, made up of a mite of the sub-family *Trombiculinae,* a rodent (*Microtus montebelloi* or a related species), a parasitic micro-organism (*Rickettsia orientalis*) and man. Both mites and rats are usually found together in patches of abandoned or cleared land, and the *rickettsia* which causes typhus is transferred from rat to mite when the latter attaches itself to the rat and sucks its blood. Man contracts the disease when he enters this zone and is bitten by the infected mite. In Malaya, the common rural rat *R. rattus jalorensis* is the virus-reservoir, and the mite has been

1. J. Portelly, 'Miscellaneous Notes Concerning a Partly Developed Region', *Malayan Med. Jrn.,* Vol. IX, No. 2, 1934, pp.51-2.
2. Ibid., p.53.
3. J.O. Poynton, 'A Preliminary Note on the Tuberculosis Problem in the Federated Malay States', *I.M.R., Bulletin, No. 3 of 1939* (Kuala Lumpur, 1939), pp.15 and 19.
4. R.B. Macgregor, *Malayan Union, Report of the Medical Department, 1946* (Kuala Lumpur, 1948), pp.8-9.
5. May, 'Medical Geography, Its Methods and Objectives.' pp.27-8.

identified as *T. deliensis,* which can only survive in temperatures of over 60°F.[1] There are two forms of typhus in the Peninsula, the urban and the rural, the latter being known as scrub-typhus because of the physical nature of the environment in which it occurs—in 'belukar' (secondary forest), in overgrown mining areas and in rubber and oil-palm estates where light cover-crops have been established. Thus all the cases observed between 1932 and 1934 at Kuala Lipis Hospital were contracted in 'belukar', and were the result of the disturbance of the vegetation, either by labourers re-cultivating the land, or by prospectors searching for gold or tin in abandoned mining land, or by cowherds grazing their cattle.[2]

There are two features of the epidemiology of the disease which are of particular significance in relation to the human geography of tropical areas. Firstly, scrub-typhus, unlike malaria, is not present in virgin forest. Three reasons have been advanced for this: (1) that the rainforest shelters only a small vector population; (2) that the vector is found in the forest canopy rather than on the ground; and (3) that the vector is not native to the rainforest but is introduced from outside.[3] Second, the disease is a man-induced one, in the sense that man, by clearing away the jungle and later allowing it to regenerate, creates the conditions necessary for the breeding of the vector's normal host—the communal rats.[4] Deforestation, whether for ladang cultivation, mining, or other agricultural purposes, and the subsequent reversion of the land to secondary forest, results in the creation of a multiplicity of 'fringe habitats'[5] which contain a greater abundance of life, such as small birds and rats and their parasites, than neighbouring habitats. Scrub-typhus occurs first in small foci ('typhus islands') which later merge into large continuous endemic areas, solely as a consequence of man's actions. Audy sums up the situation thus: 'Within a fully established endemic area, almost any circumstance encouraging a colony of rats would appear to invoke a typhus island. It is suggested that there are definite possibilities that many .... countries such as Malaya may be progressing towards such conditions.'[6] This appears to be true not only of South-east Asia, but also of the tropical areas in general.[7]

It would appear at first sight that the danger is not great in the Malay Peninsula because only a few Aborigines and Malays living in remote areas practise ladang cultivation. But the extent of abandoned land once under ladang is likely to be much wider than previously estimated, for the following reasons. Firstly, the number of Aborigines is now estimated at 100,000, which is three times the number enumerated in the 1947 Census, and with each family of four cultivating two acres at a time, the total area under ladang would be approximately 50,000 acres. Second, in practice the Aborigines seldom re-cultivate an old holding, preferring to clear a patch of virgin forest because it would give better crops

1. M.P. O'Connor, 'Typhus Fever with Special Reference to its Occurrence in Malaya', *Malayan Med., Jrn.,* Vol. X, No. 2, 1935, p.34, and Vol. X, No. 3, 1935, p.95.
2. O'Connor, op. cit., pp.25, 28, 36.
3. The latest evidence points towards the last possibility; see J.R. Audy, 'A Summary Topographical Account of Scrub Typhus, 1908 to 1946', *I.M.R., Bulletin, No. 1 of 1949* (Kuala Lumpur, 1949), p.50.
4. Ibid., p.51; also *Federation of Malaya, Annual Report of the I.M.R., 1952,* p.60.
5. A 'fringe habitat' is the result of the meeting of two types of habitat, and is different from either. J.R. Audy, 'The Ecological Effects of Deforestation and Settlement', *The Malayan Nature Jrn.,* Vol. IV, No. 4, 1948, pp.178-89.
6. Audy, 'A Summary Topographical Account of Scrub Typhus, 1908 to 1946', p.51.
7. G. Lapage, 'Disease and Tropical Industry,' *Tropical Agriculture,* Vol. XXIII, No. 4, 1946, p.62.

and would suffer less from the depredations of pests.[1] Since it takes up to several centuries for an abandoned clearing to re-establish itself as climax rainforest, it is unlikely that the area of regenerated forest is keeping pace with the area being cut down or newly abandoned. Third, mobility is the hallmark of ladang cultivation, and a holding is seldom occupied for more than two or three years. Sometimes, however, a whole Aboriginal community will move voluntarily from a freshly planted piece of land because someone has died so that the whole place becomes taboo.[2]

Ladang cultivation has been going on for centuries in the Peninsula, and it is likely that all the stages of vegetative regeneration are present. This means that there is a multiplicity of 'fringe habitats' in which scrub-typhus is likely to be endemic.

Apart from ladang, there are also large areas of land once under some form of agriculture or mining and now abandoned because of loss of soil fertility or of mineral exhaustion. In the western Tin Belt, particularly in the Kinta Valley, the Larut tin-fields of Taiping, and the Selangor tin-fields, the mined land covers some thousands of acres. Still larger areas have been devastated as a result of indiscriminate agricultural practices. Thousands of square miles of protected Forest Reserves were cut down for short-term food-crops during the Great Depression, and during the Japanese occupation, and subsequently abandoned.[3] In Penang, Malacca and particularly in Johore the 'soil-mining' methods of agriculture used by the early pioneers in growing such crops as pepper, gambier, tapioca, and pineapples have left their mark on the landscape in the form of rolling acres of sterile land covered by lalang. One estimate puts the area of seriously degraded land in Malaya at between 2,000 and 4,000 square miles (or 4 to 8 per cent of the total area of the country). This estimate does not include the less seriously degraded land.[4] In all land of this kind, as in abandoned ladang, the vectors and rat-hosts of scrub-typhus find their best feeding and breeding spots, and here again is another likely endemic zone of the disease.

The dangers of interfering with the biogeographical equilibrium either of the virgin jungle or of the secondary forest in the Peninsula are manifest from this study of the 'silent zones' of disease. Yet it is inevitable in a country such as Malaya, where there is increasing pressure of population on the land and which still has three-quarters of its area undeveloped, that there should be expansion outwards from the developed regions into the marginal areas of swamp, belukar and forest. From the malaria aspect the available techniques and knowledge in combating the disease make it less likely that it would flare up into epidemics, provided that the necessary precautionary measures are taken. But where scrub-typhus is concerned, the results of man's intrusion into the endemic zones are less predictable and more hazardous. A programme of rural development which envisages the extension of agriculture into new land, and the entry of a non-immune population into this land, cannot be successfully carried through without a heavy disease toll unless great efforts are made to reduce, if not to eliminate, the risks of infection.

1. R.C. Barnard, 'The Sakai in Trolak Forest Reserve', *The Malayan Forester*, Vol. II, 1933, pp.18-20.
2. T.A. Strong, 'The Sakai and Shifting Cultivation', *The Malayan Forester*, Vol. I, 1932, pp.243-6.
3. J. Wyatt-Smith, 'Save the Belukar', *The Malayan Forester*, Vol. XI, 1947, pp.24-6.
4. A.B. Walton, 'Land Planning and Forestry', *The Malayan Forester*, Vol. XIV, 1951, pp.212-20.

HEALTH SERVICES IN RURAL MALAYA

It is often held that living in the country-side is more healthy than living in the city, but this is now known to be a fallacy. Even in the United States and in western Europe, where health services are highly organized, the state of health of the rural population is poorer than that of the urban population.[1] As has been demonstrated, the situation is worse in the tropical regions. The peasant, because of the nature of his economic occupation, which necessitates constant contact with infected soil, exposure to disease-carrying mosquitoes, mites, flies and other insects, the lack of sanitary facilities and clean water, together with his poor state of nutrition, is much less healthy than the town dweller, who lives, as in Malaya, in mosquito controlled surroundings, and has the advantages of piped water and better choice of food. Even in the matter of housing, always a problem in the over-crowded urban areas such as Kuala Lumpur and the larger towns in the Peninsula, it is doubtful if the peasant is better off. The Chinese market-gardener or food-crop farmer lives in a wooden squatter's hut with an earth floor, often without windows, and usually next to the pigsty. His well may be polluted by water from the fish-pond which also serves as a lavatory. The Malay peasant's hut has one advantage over that of the Chinese in that it is always built on stilts so that the dangers of walking on and eating above an earth floor are absent. In other respects there are no material differences between the two. The poorer Malay builds his hut with thatched walls instead of with planks, the small back room is usually the kitchen, and is provided with a split bamboo floor through which the refuse drops on to the ground below to be picked up by chickens or goats. The hut is nearly always dark, both because of the few windows and of its situation in the midst of dense tree shade. The dark walls provide good resting haunts for mosquitoes and other insects. Perhaps the only advantage of this type of housing over the slums of the towns is that each hut is separate from the neighbouring one, so reducing the chances of tuberculosis infection due to congestion.

The need for medical and health services in the rural areas is always pressing. Preventive measures are the best form of disease control, but they are practicable only in the towns. The only alternative is to fall back on curative measures, and, within the limited effectiveness of curative treatment, to keep the more dangerous diseases within reasonable control.

Up to the beginning of the 1939-45 war, the development of the medical and health services in Malaya was restricted mainly to towns, mines and plantations.[2] The situation was the same as in other tropical regions where there was a chronic shortage of trained medical staff and funds. This meant the utilization of available funds and resources to give the greatest benefit to the largest number of people. The tendency was also to concentrate effort and resources on the more serious diseases rather than on diseases which were not fatal. Thus, crippling and purely rural diseases like filariasis and yaws were neglected until malaria, smallpox, cholera and others of a like nature were under control.

The breakdown of health and medical services throughout Malaya towards the latter years of the Japanese occupation affected all sections of the population in town and country. The strictly enforced anti-malarial regulations in most towns were allowed to lapse. Kuala Lumpur, for example, which had previously enjoyed a good malaria-free record, became so badly affected that epidemics swept the

1. S.S.B. Guilder, 'Urbanization and Social Medicine', *The Pull Exerted by Urban and Industrial Centres in Countries in the Course of Industrialization* (Brussels, 1952), p.79.
2. L.A. Mills, op. cit., pp.297-329.

town between 1942 and 1944.[1] Towards the end of the war, epidemic smallpox raged in northern and eastern Malaya where more than 4,000 cases were recorded.[2] In the rural areas, the clearing of large tracts of jungle and the cutting down of rubber estates for food-crop cultivation resulted in a flare-up of malaria. Yaws, a dirt disease, spread rapidly as sanitary conditions deteriorated and clothing became scarce. In many kampongs every child was a victim of yaws.[3] The nutritional status of the rural population dropped from already low to critically low levels, and skin diseases became almost universal.[4]

A survey of post-war medical and health services in rural Malaya shows how inadequate such services were. In 1954, there was one doctor to every 9,200 people in Malaya. This ratio varied widely from State to State, from the 1 to 4,900 in Penang to 1 to 38,000 in Kelantan, but all the predominantly Malay States of Perlis, Kedah, Kelantan, Trengganu and Pahang had ratios of between 1 to 11,700 and 1 to 38,000.[5] In comparison, Singapore had one doctor to every 2,760 persons, and (in 1949) Great Britain had 1 to 880 and the United States of America 1 to 710.[6] To provide effective service, there should be one doctor to no more than 1,000 persons.[7] The governmental hospitals in the Peninsula are all located in towns. The larger tin-mines and rubber estates have their own private hospitals. Experience (in the Belgian Congo) has shown that the effective radius of a hospital does not extend beyond ten to fifteen miles, because the peasant will not travel further than that to seek medical aid, preferring to resign himself to his fate rather than attend an institution strange to him.[8] The same natural reluctance on the part of the Malays has also been observed. Statistics of hospital admissions show a preponderance of Chinese and Indians, and a Malay minority. Assuming and effective radius of twelve miles for a hospital, the areas served by hospitals in Malaya in 1949 are depicted in Fig. 16.[9] It shows that the region well served by hospitals runs as a narrow belt from Penang and Province Wellesley along the Tin and Rubber Belt southwards to Muar in Johore, with two zones of concentration, one centred around Ipoh, and the other centred around Kuala Lumpur and Seremban. The lack of hospitals in the traditional peasant districts is well marked, especially on the east coast and the padi-growing plains of Kedah and Perlis.

Before the first World War there were, besides the general hospital at each State capital, a number of small district hospitals and outdoor dispensaries located

1. Field, 'The Institute over Fifty Years', p.216.
2. J.W. Field and D.S. Mankikar, 'Smallpox and Inoculation', *The Institute for Medical Research, 1900 to 1950,* p.229; *Proceedings of the Federal Legislative Council, February 1948 to February 1949,* p. B459.
3. *Federation of Malaya, Annual Report of the I.M.R., 1952,* p.7.
4. Malayan Union, 'Review of the Position of the Medical and Health Departments as on 30th June, 1946', *Advisory Council Paper No. 35 of 1946* (Kuala Lumpur, 1948), pp.C67-8. Also Burgess and Alang Musa, op. cit., pp.8-9.
5. *The Economic Development of Malaya* (Baltimore, 1955), Table 4, p.554.
6. J.W. Field, 'The Historical, Racial and Cultural Background of Western Medicine in Malaya', *The Institute for Medical Research 1900 to 1950,* p.32, footnote.
7. A.L. Banks (ed.), *The Development of Tropical and Sub-Tropical Countries, with Particular Reference to Africa* (London, 1954), p.xv.
8. R. Mouchet, 'The F.O.R.E.A.M.I. Health Services in the Belgian Congo', *The Colonial Review,* Vol. VII, No. 2, 1951, p.50.
9. Although there were sixty-seven hospitals in the Federation of Malaya in 1955 (*The Malayan Bulletin,* Vol. IX, No. 100, 1955, p.6), an increase of ten over the 1949 figure, the general situation has remained unchanged because of the increase in population since then, and also because the new hospitals were built in the towns rather than in the country.

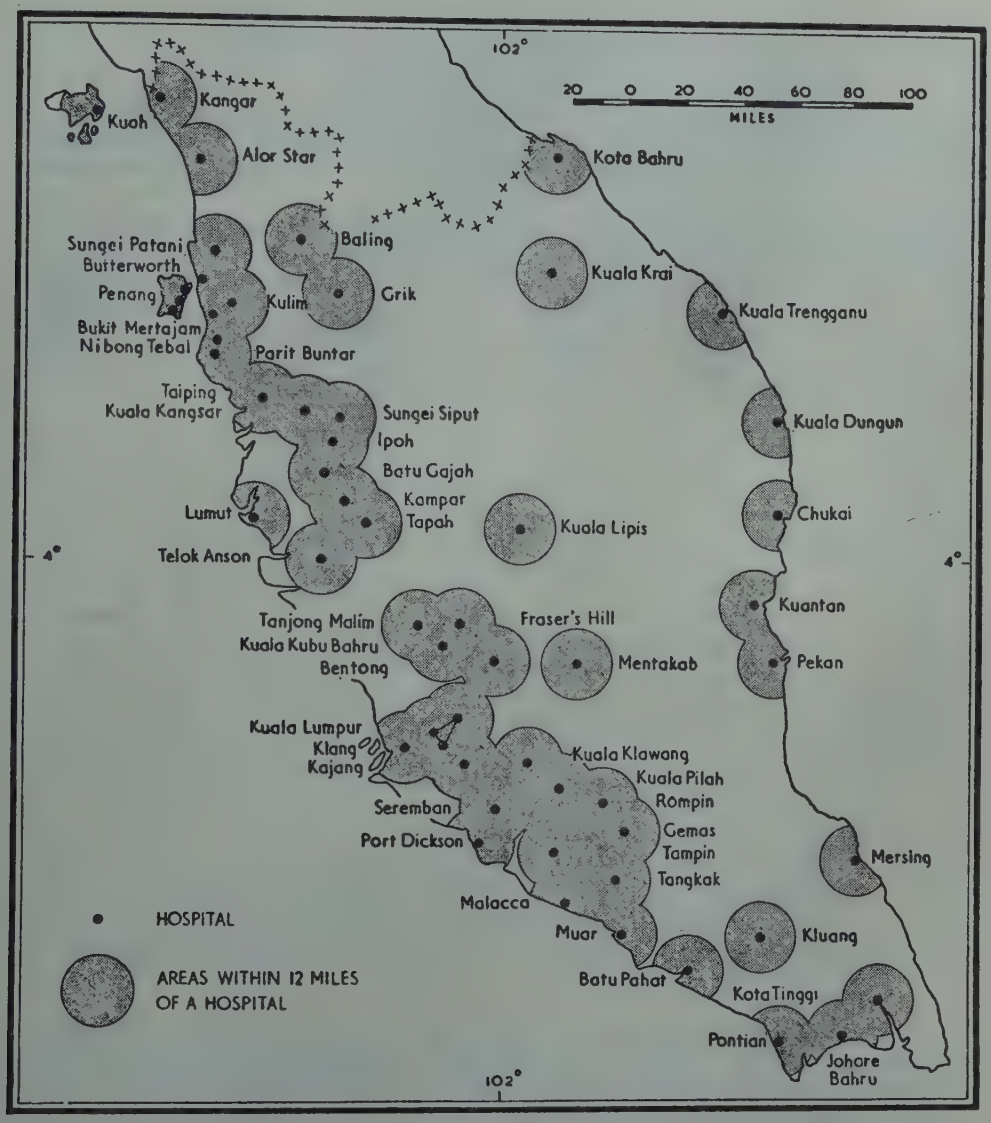

Fig. 16. Areas with Hospital Facilities, Malaya 1949.

in the rural areas. After the war, however, the development of roads and motor transport caused a change of medical policy. The small hospitals were closed, or used as outdoor dispensaries for minor complaints, and the medical facilities were concentrated in large modern hospitals in each State. The intention was that the outdoor dispensaries should serve as collecting centres for serious cases and as treatment centres for minor ones, the serious cases were to be transported to the State hospitals.[1] It is doubtful whether the original intention was ever adequately fulfilled, and whether many cases of serious illness amongst the peasant population

1. League of Nations, *Report of the Inter-Governmental Conference of Far-Eastern Countries on Rural Hygiene,* pp.12-13.

were ever sent to the hospitals, due to the reluctance of the peasants to travel long distances and be separated from their homes and families.

As Table 22 shows, each dispensary had to meet the medical needs of an average of 10,000 peasants in Malaya in 1953. The position was worse in the predominantly Malay States of Kedah, Kelantan, Trengganu and Perlis, where the ratio varied from 1 per 11,000 in Trengganu to 1 per 35,000 in Kelantan.

TABLE 22: THE RURAL POPULATION IN RELATION TO THE NUMBER OF DISPENSARIES, MALAYA, 1953

STATE	TOTAL WORKING RURAL POPULATION (THOUSANDS)	TOTAL RURAL POPULATION (a) (THOUSANDS)	DISPENSARIES				NUMBER SERVED BY ONE DISPENSARY (THOUSANDS)
			FIXED	TRAVELLING		TOTAL	
				ROAD	RIVER		
PENANG	41	123	14	3	—	17	7
MALACCA	23	72	10	5	—	15	5
PERAK	154	462	26	16	2	44	10·5
SELANGOR	70	210	36	9	—	45	5
NEGRI SEMBILAN	45	135	10	6	—	16	8
PAHANG	57	171	16	10	5	31	5·5
JOHORE	107	321	21	13	3	37	9
KEDAH	145	435	16	4	—	20	22
KELANTAN	139	417	6	3	3	12	35
TRENGGANU	57	171	8	5	2	15	11
PERLIS	30	90	6	1	—	7	13
TOTAL	869	2,607	169	75	15	259	10

(a) Assuming each working peasant supports three dependents.

Sources: (1) Table 12. The total population of the Federation of Malaya increased by 16 per cent between 1947 and 1953 [R.G.H. Wilshaw, *Federation of Malaya, Report of the Registrar-General on Population, Births and Deaths, 1953* (Kuala Lumpur, 1954), p. 1], and the total rural working population is assumed to have increased by the corresponding 16 per cent since 1947.

(2) R.E. Anderson, *Federation of Malaya, Annual Report of the Medical Department, 1953* (Kuala Lumpur, 1955), Table 14, p. 100.

The fixed dispensaries are in the villages and smaller towns, and are used by the population resident there and for a few miles around. The mobile dispensaries stop at recognized places close to the main roads or rivers such as at schools, police stations and kampongs, and are used by those within two miles or so from these centres.[1]

Although there is no differentiation in treatment among the races, the pattern of the distribution of the Malayan population is such that it is the Malays that suffer most from the lack of rural medical facilities. This situation is not peculiar to Malaya. In Africa, for instance, the committee reporting on 'Malaria under African Conditions' stated that: 'Up to the present time, the prevention or control of malaria in Africa has . . . been attempted only in the case of populations inhabiting comparatively circumscribed areas—for example, in towns and at ports, on plantations, in connection with large engineering or industrial projects, or in some areas of European farming settlement. . . . . the outstanding problem now is

1. Vickers and Strahan, op. cit., pp.4-5.

to devise methods and means of lessening the incidence, or the effects, of the disease among the great indigenous rural populations of the continent.'[1] In Africa, as in Malaya, it is the indigenous rural population that is neglected.

In Malaya plans were made for the construction of twenty-five rural medical centres between 1953 and 1956, each with small static clinics in its neighbourhood as collecting foci for the district hospital.[2] In 1954 a draft plan for full rural health services was drawn up, aiming at the creation of ninety main centres and 450 satellites, the construction to be partly financed by funds from Colonial Development and Welfare grants. The scheme is highly ambitious, but the chances of its fulfilment seem to be slender. The lack of funds and staff is acute. However, the level of living in Malaya, as in other tropical countries, cannot be raised without adequate control of disease.

1. The League of Nations, *Quarterly Bulletin of the Health Organization,* Vol. V, No. 1, 1936, p.110.
2. *Federation of Malaya, Annual Report of the Medical Department 1952,* p.17.

CHAPTER IV

TROPICAL SOILS AND AGRICULTURAL DEVELOPMENT

THE INFERTILITY OF TROPICAL SOILS

THE MAJORITY of the population in tropical areas is dependent upon agriculture for a livelihood. Thus the capacity of any tropical community to attain a higher level of living will depend upon its ability to increase its agricultural production. An important factor affecting production and rural development in the tropics must therefore be the nature and characteristics of tropical soils.

The concern here is with the great mass of soils developed under humid tropical conditions, which pedologists have put under the collective heading of 'lateritic soil', or 'tropical red earths', or more recently 'latesols'.[1] These soils have several characteristics in common, the most striking of which is their red colour. Kellogg lists eight other common characteristics,[2] but only those that relate to soil fertility (defined by Crowther as 'potentiality for crop production'[3]) have a direct relevance to this study.

The fertility of a soil depends on the amount of soil nutrients (or plant food), both organic and inorganic, present in it. The amount of chemical plant nutrients in latesols is generally low. The lack of phosphorus and a low level of bases render the soils highly acid, while the amount of nitrogen is usually too small to give optimum crop yields. But in tropical areas it is not so much the amount of chemical nutrients as the content of organic matter which determines the soil fertility.[4] The amount of organic matter in latesols varies considerably. Kellogg quotes a figure of from 2 to 6 per cent or more.[5] Gourou states that the forest soils of Yangambi in the Belgian Congo have a maximum organic content of 1.8 per cent as compared with the 10 per cent of temperate soils.[6] Coulter states that the amount of organic matter in Malayan soils rarely exceeds 12 per cent as compared with 25 to 30 per cent in the soils of the steppes and prairies of temperate lands.[7] All are agreed, however, that the amount of organic matter in tropical soils is very low compared with temperate soils. Salvadori

1. C.E. Kellogg, 'Preliminary Suggestions for the Classification and Nomenclature of Great Soil Groups in Tropical and Equatorial Regions', *Proceedings of the First Commonwealth Conference on Tropical and Sub-Tropical Soils, 1948* (Harpenden, 1949), pp.76-85.
2. C.E. Kellog, 'Tropical Soils', *Transactions of the Fourth International Congress of Soil Science, 1950, Vol. I* (Groningen, 1950) pp.268-9.
3. E.M. Crowther, 'Soil Fertility Problems in Tropical Agriculture', *Proceedings of the First Commonwealth Conference on Tropical and Sub-Tropical Soils, 1948,* p.135.
4. 'Organic Matter' consists of dead matter, including fallen leaves, branches, fruit and other dead vegetation which fall upon, and are subsequently taken up by the soil. It includes also living organic matter, such as soil flora and fauna which are made up of innumerable micro-organisms. See E.C.J. Mohr, *The Soils of the Equatorial Regions, with Special Reference to the Netherlands East Indies* (Michigan, 1944), pp.97-8.
5. Kellogg, 'Tropical Soils', pp.272-3.
6. Gourou, op. cit., pp.16-17.
7. J.K. Coulter, 'Organic Matter in Malayan Soils: A Preliminary Study of the Organic Matter Content in Soils under Virgin Jungle, Forest Plantations and Abandoned Cultivated Land', *The Malayan Forester,* Vol. XIII, 1950, p.190.

estimated that the soils of East Africa had a productive capacity of only 2 to 3 per cent of the soils of Europe,[1] though some consider this to be an exaggeration.[2]

Crop yield gives a good indication of the fertility of the soil on which it is grown. van Hall has collated the yields of albumen, carbohydrates and fats produced per hectare by different crops which he regarded as being typical of those grown in temperate and tropical areas. The average yields of the 'albumen and starch' crops (potatoes and wheat) in representative temperate countries, were compared with those of rice in representative tropical countries. The same comparison was made for the 'fat' crops, as represented by rapeseed in the temperate countries and groundnuts in the tropics. In each case the yields of albumen, carbohydrates and fats per hectare in the tropics were significantly lower than those in the temperate areas.[3]

In a similar manner it is possible to compare the yields of certain crops, such as rice and maize, which are grown in both temperate and tropical areas (see Figs. 17 and 18). Such comparisons confirm that the yields in the tropics are lower, sometimes very much lower, than those in temperate areas.

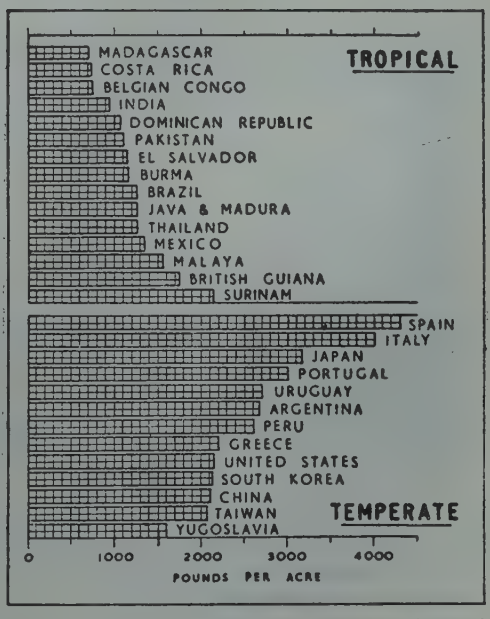

Fig. 17. Yields of Rice per Acre in Tropical and Temperate Countries, 1951.

It is not implied, however, that the poorer yields in the tropics are due solely to the infertility of the soils. The yield of any cultivated crop depends on the interaction of physical (climate and soils), and human (methods of cultivation, irrigation and use of fertilisers) factors, and the relative significance of any one factor is difficult to define. Where crop yields are largely determined by soil fertility agriculture in the tropics is less rewarding than in temperate areas, due to the infertility of most tropical soils. The practical implication is, therefore, that a greater expenditure of time and effort and a larger area are necessary in the tropics if the peasant is to attain the yield which the temperate peasant ordinarily obtains.

Climate and Soil Infertility. The low fertility of latesols in most tropical countries suggests a common causative factor. In this case it is the tropical climate which is mainly responsible. The tropical climate, with temperatures 50°F to 70°F higher and rainfall twenty to thirty times heavier than those in Europe,

1. M. Salvadori, 'White Settlement in the Colonial Territories of the Tropics', *Comptes Rendus du Congres International de Geographie, Amsterdam, 1938* (Leiden, 1938), Tome III, Sec. IIIc, p.311. Also Lord Hailey, *An African Survey* (Oxford, 1938), p.880.
2. H. Vine, 'Is the Lack of Fertility of Tropical African Soils Exaggerated?, *Proceedings of the Second Inter-African Soils Conference, Leopoldville, August 1954, Belgian Congo, Vol. I* (Brussels, 1954), Document 26, Sec. IIBb, pp.389-412.
3. C.C.J. van Hall, 'Why does the European fail as a Small Farmer in Tropical Countries?', *Comptes Rendus du Congres International de Geographie, Amsterdam, 1938*, Tome II, Section IIIc, p.127.

induces a great speeding up of chemical reactions and weathering processes in the soils, which continue without a break throughout the year.[1] In a humid tropical climate, where the annual precipitation exceeds the annual evaporation, the characteristic water movement is continuously downward, in contrast to the upward capillary movement in arid climates. This downward movement leads to a continuous leaching action from the surface of the soil downwards. The easily dissolved bases are removed so that the soil becomes highly acid, and the original character of the parent rock is soon altered as weathering and leaching continue. Leaching also washes out organic matter and plant nutrients which cannot be replaced by capillary action, but only through addition from above, that is through the rotting of other dead organic matter.[2]

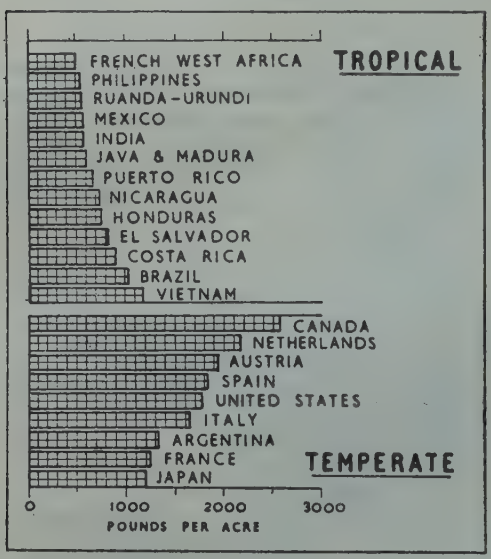

Fig. 18. Yields of Maize per Acre in Tropical and Temperate Countries, 1954.

The rate of decomposition of organic matter has been found to proceed faster as the temperature increases, and the higher the temperature the more rapid is the oxidation.[3] According to Mohr, the addition of organic matter to an adequately aerated soil starts at O°C and reaches its optimum at about 25°C (77°F), and its maximum at about 40°C (104°F.). The destruction of soil organic matter starts from a higher temperature range, the micro-organisms responsible being inactive until temperatures of between 10°C (50°F) and 15°C (59°F) are reached. The optimum temperature is 35°C (95°F) or higher. The maximum rate of destruction takes place at temperatures normally higher than occur in a soil. From these temperature ranges, he concludes that at soil temperatures of 0°C to 20°C (32°F to 68°F) there is an increasing surplus of organic matter, above this range it diminishes, and at 25°C (77°F) the curves for the formation and breakdown of organic matter cross. Above this equilibrium temperature no organic matter will accumulate.[4] Theoretically there should be no humus accumulation in well drained lowland rainforest soils where soil temperatures are about

1. P. Vageler, *An Introduction to Tropical Soils* (London, 1933), pp.4, 16; and B.A. Keen, 'The Role of Organic Matter in Tropical and Sub-Tropical Soils', *Plant and Animal Nutrition in Relation to Soil and Climatic Factors* (London, 1951), pp.423-5.
2. Crowther, op. cit., p.136; and Mohr, op. cit., p.114.
3. F.C. Gerretsen and S.A. Waksman, 'The Influence of Temperature on the Nature and Decomposition of Natural Plant Materials by Micro-organisms', *Proceedings and Papers of the Second International Congress of Soil Science, Moscow, 1930* (Moscow, 1932), Commission III, p.179.
4. E.C.J. Mohr, *Tropical Soil-Forming Processes and the Development of Tropical Soils, with Special Reference to Java and Sumatra* (University of Philippines, 1930), pp.17-20. Also Corbet, op. cit., pp.90-106.

77°F, but in actual fact some does accumulate, though the content does not exceed 1 or 2 per cent except in the top ten to twenty centimetres.[1]

It has been similarly established that the high annual temperatures of the tropics are inimical to nitrogen accumulation in the soil. Jenny, after analysing soil samples over a wide climate range in the United States of America, concluded that the total nitrogen content of the soil decreased from north to south in constant relation to the mean annual temperatures, and in general the average nitrogen content of the soil decreased two or three times with every 10°C (18°F) rise in temperature.[2] Thus while it is possible in temperate areas to build up the nitrogen content of the soil by adding organic material, in the tropics the high temperatures are continuously working against this accumulation.

The Closed Soil-Nutrient Cycle. The climate of the tropics always favours the destruction of humus and nitrogen in the soil. The destructive process can only be slowed down or countered through the addition of large quantities of organic material to keep pace with the rate of breakdown, and through keeping the soil temperatures at or below the level at which the process of humus formation gives place to humus breakdown, that is, at around 77°F. Both these requirements are fulfilled in a tropical lowland forest. The decomposition of the parent rock releases fresh plant nutrients which are taken up in dilute solution by deep-rooted plants reaching into the deeply weathered rock. Leaves, twigs, flowers, fruit, branches and whole tree trunks are constantly falling on to the forest floor, where they are immediately set upon by termites, ants and other insects and earthworms and broken down. Rainwater also partially dissolves the plant remains. These are subsequently attacked by soil micro-organisms which transform them into various gases and acids, leaving a dark-coloured residue (humus) from which plant nutrients are set free.[3] The nutrients are quickly absorbed again by the plants, especially the shallow-rooted ones.

A closed cycle is thus set up, in which the plant food is circulated from the top-soil, taken up by the vegetation, and then returned to the soil again to start the process anew. The resources of the parent rock are tapped to make good the losses due to drainage.[4] The process is many times faster than in temperate forests, and a small amount of nutrients circulating rapidly suffices to maintain the dense vegetation of the tropical rainforest.[5] The 'tropical forest works with a small capital of nutrients and a rapid turnover.'[6] The state of equilibrium is maintained at soil temperatures of 75°F to 76°F, when the rate of humus formation equals that of its breakdown. In the Malay Peninsula, for instance, the soil temperatures under lowland rainforest show a fluctuation of only 1°F on either side of 75°F, due mainly to the heavy shade and the transpiration of moisture from the leaf canopy.[7]

1. Vageler, op. cit., p.7.
2. H. Jenny, 'Relation of Climatic Factors to the Amount of Nitrogen in Soils', *Journal of the American Society of Agronomy*, Vol. XX, No. 9, 1928, pp.900-12; and H. Jenny, 'Relation of Temperature to the Amount of Nitrogen in Soils', *Soil Science*, Vol. XXVII, No. 3, 1929, pp.169-88.
3. Mohr., op. cit., pp.108-9.
4. P.W. Richards, *The Tropical Rainforest: an Ecological Study* (Cambridge, 1952), pp.219-20.
5. H.J. Page, 'Soil Problems in Tropical Crop Production', *Tropical Agriculture*, Vol. XIX, No. 2, 1942, pp.21-2.
6. Ramann, quoted in *Tropical Agriculture*, Vol. VI, No. 3, 1929, p.66.
7. W.B. Haines, 'The Cultivation and Manuring of Rubber Trees', *Proceedings of the First Commonwealth Conference on Tropical and Sub-Tropical Soils, 1948*, p.218.

The luxuriance of the rainforest is not due to inherent soil fertility, but to the special conditions of shade and temperature, and the abundance of vegetative raw material from which the small capital of plant nutrients is built up, expended and rebuilt. The cycle continues as long as conditions remain stable, that is, as long as the forest stands.

When the forest is cut down the cycle of nutrients is broken. The first effect of forest clearing is to expose the soil to the direct rays of the sun, and so raise the soil temperature. The extent to which soil temperatures are raised depends on the degree of exposure. Over bare soil, for instance, Mohr found surface soil temperatures of between 113°F and 140°F (in Indonesia) when the atmospheric temperatures were only 77°F to 86°F.[1] In East Africa, Vageler noted surface temperatures of 122°F to 131°F over bare soil when the maximum air temperatures were only between 78°F and 86°F.[2] In the Malay Peninsula daily records kept over a period of twenty-three weeks showed that the mean soil temperature at a depth of two inches over bare soil was 84°F, and the greatest daily range was 35°F, the lowest minimum being 73°F and the highest maximum 112°F. A surface mulch of dried grass laid over the soil reduced the daily range without decreasing the mean soil temperatures, but a low creeper cover produced a decrease in mean soil temperatures of 3°F to 4°F, and also reduced the daily range.[3] Recent experimental work by the Forestry Department in Malaya confirmed these general conclusions as is evident from Fig. 19.

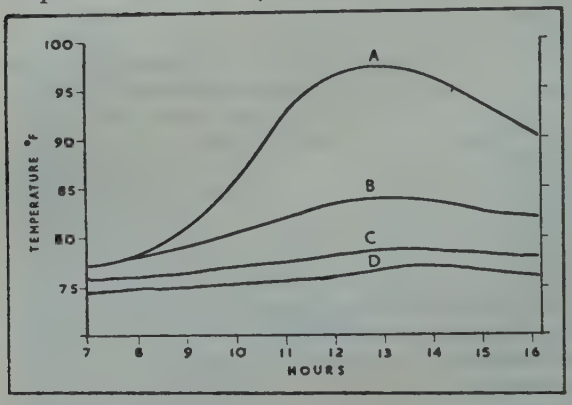

Fig. 19. Mean Soil Temperatures at Two Inches Depth under Different Covers, Malaya.
A. Bare unshaded soil. B. Soil shaded by atap raised three feet above ground. C. Soil under 'Keladan' (*Dryobalanops oblongifolia*) eighty feet tall forming complete overhead canopy. D. Soil under 'Kapur' (*D. aromatica*) fifty feet tall forming complete canopy. Source: R.C. Barnard 'Research Items: Forest Nursery Surface Soil Temperatures', *The Malayan Forester*, XIV, July, 1951, p.159.

All the investigators have recorded increases in soil temperatures varying from 7°F to 63°F when the forest canopy is removed. These increases lead in turn to an acceleration of the rate of humus decomposition, and, at the same time, exposure of the humus layer to the direct rays of the sun intensifies the rate of its destruction.[4] Also the addition of plant waste from the forest is suspended, and the small store of nutrients in the top layers of the soil which is rapidly being depleted cannot be replenished. If the forest is allowed to regenerate itself immediately, the process of soil impoverishment is arrested before much harm can be done. But if there is a long period of cultivation after the forest is cleared, and especially if the crops do not provide a good permanent foliage cover, the soil structure, humus content and nutrient status of the soil are radically transformed and will progressively deteriorate.

1. Mohr, op. cit., p.42.
2. Vageler, op. cit., pp.104-5.
3. Haines, op. cit., pp.16, 17, 22.
4. Vageler, op. cit., pp.104-5; also A.S. Corbet, 'The Bacterial Numbers in the Soil of the Malay Peninsula', *Soil Science*, Vol. XXXVIII, 1934, pp.407-16.

The Soil Structure. Apart from its fertility, the productivity of the soil also depends upon its physical structure.[1] The structure of the soil under forest conditions is usually good. It is porous and, due to the work of micro-organisms which bind loose particles of soil into friable crumbs, capable of resisting erosion.[2] Under stable conditions of forest growth the number of micro-organisms remains in equilibrium, but when the forest is cut down microbial activity is reduced and the soil structure breaks down.[3] The structure may become massive, compacted and very hard, and may deteriorate to a state of excessive granulation in which the soil provides too few contacts for the plants to take in water and nutrients.

The Effects of Forest Clearing on Soil Fertility. The initial effect of forest clearing is to release quantities of plant nutrients which become available to the cultivated crops instead of the forest trees. The acceleration of decomposition serves also to convert the existing organic raw material into plant food, so that the overall result is an early forced growth of crops and a satisfactory harvest. Such initial quick growth has been observed in rubber trees planted on recently cleared forest land in Malaya.[4] But the effect does not last, for after the first year the capital of plant nutrients is practically exhausted, and continued cultivation results in a marked falling off in crop yields. In British Honduras, for example, the yield of maize on forest clearings fell from between 800 and 1,000 lb. per acre in the first year to between 400 and 600 lb. in the third year.[5] In Indonesia, the padi yields at a colonization project at Sukadana in south Sumatra fell from 42 quintals per hectare in the first year to 37, 31, 30 and 27 quintals in successive years.[6]

A series of experiments were conducted in Malaya to determine the relative fertility of jungle, plantation and abandoned cultivated land. There were large differences in their fertility level as judged by the nitrogen content in the soils. The average N_2 content in jungle soil was 0.240 per cent; in plantation (tree crop) soil 0.155 per cent, and in abandoned cultivated soil 0.124 per cent.[7] The general conclusion was that the greater amount of nitrogen was one of the factors stimulating early growth when the jungle was first felled and the land planted to crops. The fall in yield of crops after the first planting was due to the deterioration of the crumb structure, and a decrease in soil fertility.[8]

The process of soil degradation is represented diagrammatically in Fig. 20. Profile 'A' is typical of undisturbed forest. The trees depend upon the organic

1. F. Hardy, 'Soil Productivity in the British Caribbean Region', *Tropical Agriculture,* Vol. XXVIII, No. 1, 1951, pp.3-4; and F. Hardy, 'Some Ecological Aspects of Tropical Pedology', *M.J.T.G.,* Vol. 2, 1954, pp.3-4.
2. R. J. Swaby, 'Relationship between Micro-organisms, Organic Matter and Soil Structure', *Plant and Animal Nutrition in Relation to Soil and Climatic Factors* (London, 1951), pp.90-1.
3. A.G. Lockhead, 'The Bacterial Equilibrium in Soil in Relation to Plants', *Plant and Animal Nutrition in Relation to Soil and Climatic Factors,* pp.92-7.
4. Edgar, op. cit., pp.18, 19.
5. C.F. Charter, *A Reconnaissance Survey of the Soils in British Honduras* (Trinidad, 1941), p.16.
6. Van der Voort, quoted by F.A. van Baren in *Transactions of the Fourth International Congress of Soil Science, 1950* (Groningen, 1950), Vol. 4, p.126.
7. Coulter, op. cit., Tables III to V, pp.199-202.
8. Ibid., pp.195-7. Also R.G.H. Wilshaw, 'Studies in Malayan Soils', pp.4-24.

layers of the first three inches of soil, and on the mineral layer immediately below, which is enriched by organic matter washed down from above. Below this level is the highly acid, infertile dead layer almost totally leached of nutrients, grading gradually into parent rock. Profile 'B' shows the result after the forest has been cleared, burnt and cultivated. The humus top layer has disappeared, including the litter crumb, and the profile is said to be 'truncated'. The soil fertility then largely depends upon the amount of nutrient left in the original parent rock, which is usually low. The process of degradation and leaching following crop cultivation leads first to a deficiency in nitrogen, and later to phosphorus deficiency, and then to a shortage of bases such as magnesium, calcium and potassium, and finally to the loss of certain essential trace elements. As well as losing its fertility, the physical structure of the soil also deteriorates and becomes an unfavourable medium for plant growth.[1]

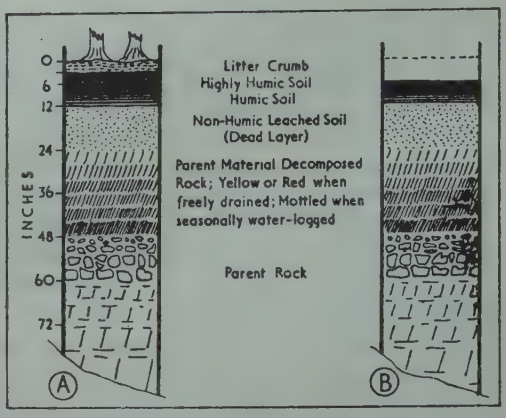

Fig. 20. Soil Profiles under (A) Forest, (B) Field Crops.
Based on F. Hardy, 'Soil Productivity in the British Caribbean Region', *Tropical Agriculture*, Vol. XXVIII, No. 1, 1951, App. p.25.

THE FERTILITY STATUS OF MALAYAN SOILS.

Malayan soils have been classified according to their parent material and on a geological basis. The influence of the parent material in determining soil differences is considered to override that of climate. Climate in the comparatively small area of Malaya is considered as being relatively uniform, from the pedological point of view.[2] It is proposed to summarize the characteristics of the main soil groups in Malaya with reference to their agricultural value (taking Fig. 21 as a rough guide to their distribution), both to illustrate the level of fertility of soils in a typical humid tropical area, and also to serve as a background to the discussion, in later chapters, of the problems of Malayan agriculture.[3]

Coastal Alluvial Soils. The coastal alluvial soils are derived from deposits transported by the rivers from the other inland soils which have developed in situ. They are therefore quite different from the rest of Malayan soils, and they also vary considerably within themselves as regards their agricultural value. Along

1. Hardy, 'Soil Productivity in the British Caribbean Region', pp.22-5.
2. For further details, see W.N.C. Belgrave, 'General Considerations on a Soil Survey of Malaya', *M.A.J.*, Vol. XVII, No. 7, 1929, pp.175-8; and J.H. Dennett, 'The Classification and Properties of Malayan Soils', *M.A.J.*, Vol. XXI, No. 8, 1933, pp.347-61.
3. This summary account of Malayan soils is based on the following main sources: J.H. Dennett, 'The Western Coastal Alluvial Soils', *M.A.J.*, Vol. XX, No. 6, 1932, pp.298-303; S.G. Willimott and T.A. Buckley, *The Soils of Malaya: their Classification and Characteristics* (Kuala Lumpur, 1948); Dennett, 'The Classification and Properties of Malayan Soils', passim; and Owen, 'A Provisional Classification of Malayan Soils', pp.20-42.

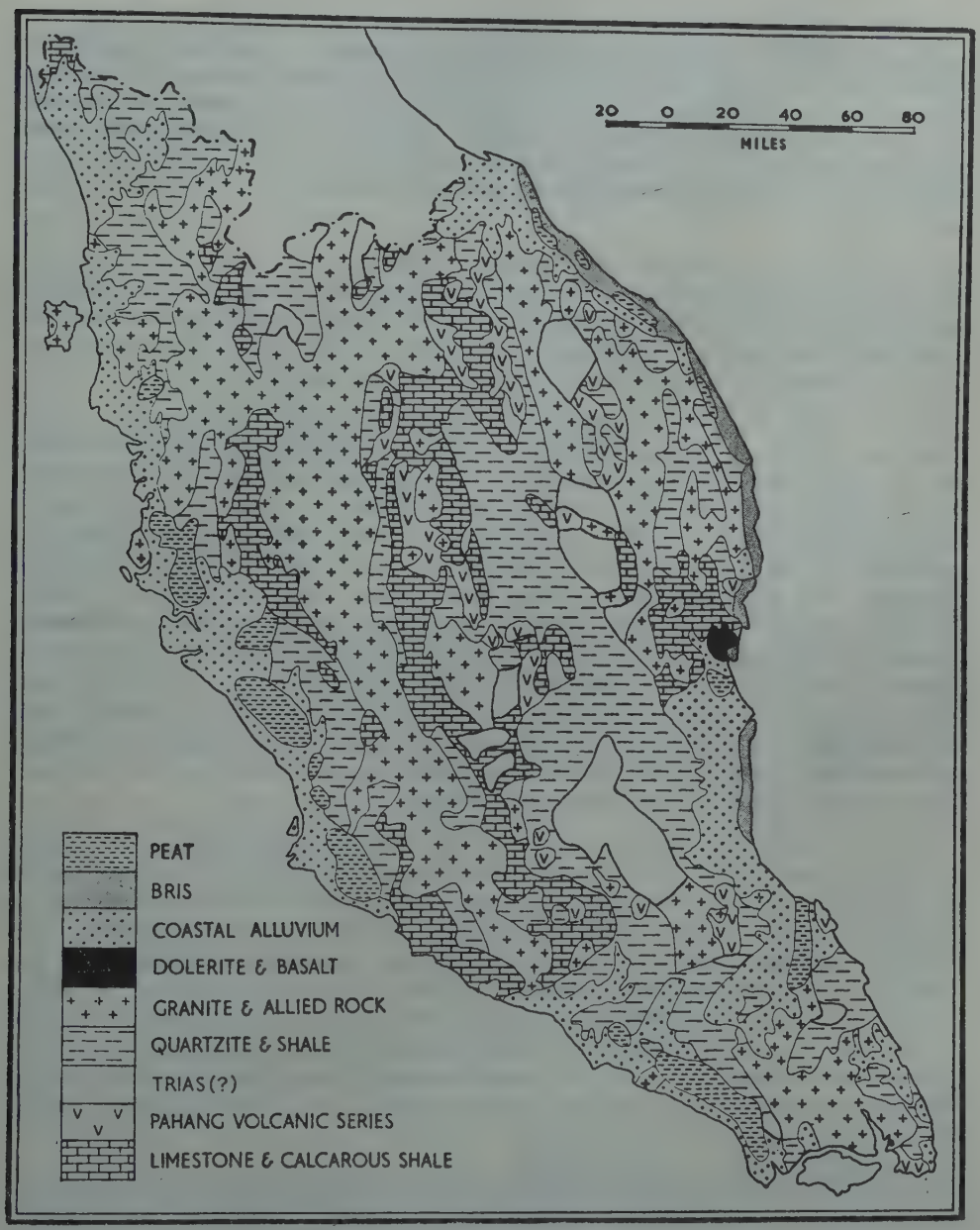

Fig. 21. Geology, Malaya.

Source: *Geological Map of Malaya* (Survey Department, Federation of Malaya No. 35-1948).

the west coast the alluvial soils stretch in an almost unbroken belt, varying in width from five to fifty miles, from Perlis to Selangor, and all along the Johore coast. Their distribution along the east coast is more limited. They are confined to a belt from the Kelantan Delta to Kuala Trengganu, and to a broad belt between Kuantan and Mersing.

The coastal alluvial soils are divided into two main types, coastal clays and peat soils, with a transitional type called organic soils. A local soil type called 'bris' also occurs along the east coast. Working inland from the coast, the coastal clays of the west coast grade into organic soils and then into peat soils. On the east coast the sequence is first, a narrow stretch of 'bris' interspersed with occasional stretches of peat, and inland from the 'bris', and occurring mainly in the Kelantan, Pahang and Endau River deltas, is a broad belt of coastal clay and organic soils.

Coastal clays are highly acid, and vary considerably in texture and structure depending upon the quantity of fine sand present. They are generally considered the most fertile soils in Malaya, though their fertility is lowered where drainage is restricted. Besides padi, which is the main crop on these soils, coconuts, rubber, oil-palm, pineapples and other minor crops are also grown on them.

Peat soils of varying thickness are common not only to Malaya, but are found everywhere in lowland South-east Asia.[1] In Malaya the area covered by peat has been estimated at one million acres, occurring in three main localities: (1) the Pontian area of south Johore, (2) the Selangor coastal region including Tanjong Karang, and (3) the trans-Perak area near Sitiawan, which has an estimated area of one-quarter of a million acres, and which is to be developed for padi.[2] The depth of the peat varies from one to forty feet. Due to the low content of mineral matter, peat soils are generally infertile. There is a marked deficiency of nitrogen, and the content of lime varies from 0.14 to 0.5 per cent, phosphate varies from 0.01 to 0.09 per cent and potash from 0.02 to 0.2 per cent. When cultivated for some years there is a marked deterioration in fertility and minor element deficiencies become evident. Some of the 'masam kelat' (very sour) soils associated with 'gelam' (*Melaleuca leucadendron*) vegetation in Malacca, Kelantan and Trengganu are extremely infertile.[3]

The agricultural value of peat soils depends upon the depth of the peat. Where it is one to two feet deep, a good soil can be formed by mixing it with the underlying clay, but where it is more than two feet thick, deep drainage is essential before it can be cultivated. The draining of peat soils is difficult, for over-rapid drainage reduces the peat to a brown dry powder impossible to re-condition. Also the progressive lowering of the water table leads to a shrinking in the peat surface, and rubber and coconut trees planted on peat soils often tend to lean and fall over as their roots become exposed. Little padi is grown on peat as it is believed that padi will not do well on such soils.[4] The crops that can be cultivated on peat are pineapples and vegetables, both shallow-rooted plants. Rubber grown on peat gives low yields.

Organic soils are intermediate in quality between coastal clays and peat, in fact they are coastal clays containing over 20 per cent of undecomposed organic

1. B. Polak, 'Occurrence and Fertility of Tropical Peat Soils in Indonesia', in *Transactions of the Fourth International Congress of Soil Science, 1950*, Vol. 2, pp.183-5; also Mohr, op. cit., pp.97-8.
2. J.K. Coulter, 'Peat Formations in Malaya', *M.A.J.*, Vol. XXXIII, No. 2, 1950, pp.63, 78-9; and *Federation of Malaya, Annual Report of the Department of Agriculture, 1948* (Kuala Lumpur, 1949), pp.40-1.
3. Heath, op. cit., p.43.
4. Coulter, 'Peat Formations in Malaya', p.63.

matter (peat may contain as much as 80 per cent). 'Bris'[1] is a white sandy soil containing more than 80 per cent sand (Table 23). The largest continuous stretch of 'bris' occurs along the coast from Kota Bharu in Kelantan to the southern Trengganu border, an area of over a quarter of a million acres. These soils are practically sterile and consequently of little agricultural value.

TABLE 23: ANALYSES OF SOME MALAYAN SOIL TYPES

CHEMICAL ANALYSES

SOIL TYPE	NITROGEN PERCENTAGE	HYDROCHLORIC ACID EXTRACTS				
		Fe_2O_3 AND Al_2O_3	CaO	K_2O	P_2O_5	MgO
COASTAL ALLUVIUM — CLAY ALLUVIUM	0·246	30·71	0·011	0·726	0·095	0·020
COASTAL ALLUVIUM — SANDY ALLUVIUM	0·215	16·70	0·078	0·230	0·050	0·070
COASTAL ALLUVIUM — 'BRIS'	0·045	0·25	0·011	0·003	0·008	0·011
QUARTZITE	0·078	13·81	0·006	0·008	0·021	0·003
RAUB SEDIMENTARIES — LOW LEVEL RAUB	0·085	8·96	0·020	0·255	0·028	0·057
RAUB SEDIMENTARIES — PALE YELLOW RAUB	0·078	19·07	0·006	0·612	0·020	0·107
GRANITE	0·073	24·98	0·004	0·169	0·013	0·200
PAHANG VOLCANIC SERIES	0·062	41·34	0·038	0·019	0·258	0·018

MECHANICAL ANALYSES (a)

SOIL TYPE	CLAY PERCENTAGE	SILT PERCENTAGE	FINE SAND PERCENTAGE	COARSE SAND PERCENTAGE	GRAVEL PERCENTAGE	pH(b)
COASTAL ALLUVIUM — CLAY ALLUVIUM	71·0	12·0	8·0	3·0	0·0	4·3
COASTAL ALLUVIUM — SANDY ALLUVIUM	40·1	16·6	28·1	12·9	1·7	4·6
COASTAL ALLUVIUM — 'BRIS'	3·5	4·5	3·5	79·0	9·0	5·6
QUARTZITE	44·8	18·3	29·2	9·6	2·2	4·6
RAUB SEDIMENTARIES	35·0	29·0	28·0	6·0	1·1	4·6
GRANITE	30·0	15·2	17·4	20·3	15·0	4·4
PAHANG VOLCANIC SERIES	44·1	14·0	20·0	14·8	1·1	5·4

(a) Mechanical analyses were carried out on the top twelve inches.
(b) pH measurements were carried out on the top six inches.

Source: Willimott and Buckley, op. cit., App. Tables 2 and 4.

Soils derived from Igneous Rocks. Granite and other non-volcanic igneous rocks cover half the total area of the Peninsula. Most of the high mountain ranges are of granite. The residual soils derived from the acid granite are fairly uniform in their characteristics, being red to yellow in colour, and with low nutrient content, although able to support good stands of rubber. The texture of the soil under forest is good, being friable, deep and permeable, but if cleared and cultivated under food-crops, it tends to pack and form a hard impermeable crust. Though soils derived from granite probably cover a greater area than any

1. "Bris' is a Kelantan word used to describe the series of old raised beaches that run parallel to the coast. These beaches are characteristic features of the east coast landscape, and are known as 'permatangs' in Pahang and elsewhere.

other soil type, they are located mainly on mountain sides too steep for agriculture. Where they are found on undulating land or lowland, as in the stretch from Negri Sembilan to Malacca, in the Perak River Valley and in the Kemaman area on the east coast, they are developed extensively for agriculture.

The soils derived from basic igneous rocks (shown as Pahang Volcanic Series and Dolerite and Basalt in Fig. 21) are limited in area. But they are of particular interest because they are the most fertile of the residual soils, and are suitable for cocoa cultivation. Nearly all of them are in eastern Malaya. They have a high nutrient level and are deep and very friable, and their fertility is attested by the high yields from rubber planted on them. They are comparable in fertility to the basic volcanic soils of Java and Sumatra. Although their estimated area is a million acres, the actual acreage of fertile soils may be considerably less.

Soils derived from Sedimentary Rocks. Sedimentary rocks occupy about one third of the total area of Malaya. Soils derived from them are distributed over the major portion of the foothill and undulating lowland regions of the Peninsula, where the greatest agricultural development has taken place. But they are of low inherent fertility and their agricultural value lies mainly in their soil structure. The latter varies considerably according to the age and degree of weathering, and the nature of the parent material. Quartzites, for example, weather into soils that have little crumb structure, they pack easily upon exposure, becoming hard so that they resist root penetration and favour erosion. The nature of the parent material determines the depth of weathering that can take place. Where they are hard sandstone or schists, the soil is shallow and gravelly, but where the bedrock is shaly, weathering may extend down to a depth of thirty feet. Carboniferous shales weather into black soils with a high percentage of carbon, such soils are almost sterile.[1] Soils derived from schists, shales and phyllites contain varying amounts of ferruginous concretions, usually deposited in a pan which hardens into a slag-like mass on exposure. Where the pan is near the surface, rubber trees do not grow well because the hard layer resists root penetration. As a rule the soil structure deteriorates on exposure, and such soils are unsuitable for crops which do not provide adequate cover for the surface, but they support good growths of tree crops such as rubber.

Limestone Soils. Although calcareous shales and limestones underlay extensive areas of the Peninsula, it is only in a few localities that they are exposed. Limestone outcrops rise abruptly from the plains—in Perlis, the Kinta Valley and Selangor. In these localities limestone soils are found covering small areas around the base of the limestone hills. They are very fertile, and have a pH value of between 6 and 8.5.

According to Owen the majority of Malayan soils fall into the low fertility 'latesol' category.[2] The annual Malayan rainfall exceeds the rate of evaporation, and the continuous downward movement of water intensifies the leaching process, removing soluble organic matter and most mineral matter, except iron and aluminium oxides and quartz. Malayan soils are also pedologically mature. Leaching and soil impoverishment have been going on uninterruptedly for a very long time, and have reduced the residual soils to a broadly similar pattern of low fertility. The high acidity and lack of accumulated nitrates in Malayan soils

1. Quartzite valley soils are also very infertile. Chinese squatters who occupy them have to use large quantities of pig manure to fertilize them. J. Lambourne, 'Studies in Malayan Soils, Pt. IV, Experiments on the Conditioning of an Infertile Soil', *M.A.J.*, Vol. XXII, No. 10, 1934, pp.457-73.
2. Owen, op. cit., p.39.

are an indication of the intensity of the leaching process.[1] The small amount of nutrient that does remain in the soils is due to intense weathering, which breaks down the complex minerals and makes them available as plant food.[2]

The structure of Malayan soils is also a handicap to agriculture. In the foothills and on undulating land, the texture of forested soils is generally good and free-draining. When the forest is cleared the soil structure is destroyed, and the soil becomes compacted, and may form a hardened crust. On steep slopes this crust acts as a barrier to water percolation, so that plants here may suffer from all the effects of drought although the rainfall may be heavy. Dennett cites the example of oil-palms which give a low yield when grown on steep slopes because of the poor soil structure.[3] It has also been established that the deleterious effects of soil exposure are felt sooner when the soil is mechanically disturbed by digging or ploughing. Soils whose structure deteriorates quickest on exposure are those derived from schists, shales and phyllites. Granite soils are fairly stable, but the best soils, from the point of view of structure, are those derived from basic igneous rocks.[4]

TROPICAL SOILS—EXCEPTIONS

So far the focus of attention has been on those varieties of tropical soils which are of low fertility and come under the heading of 'latesols'. But within the compass of tropical soils as a whole these are intermediate in quality between the most fertile and the poorest soils.[5] The most fertile and the very poor soils may be considered as exceptional. In most cases they are the direct result of physical pedological processes, but in some they occur as a result of the activities of ants, earthworms, or termites. Termites are found in large numbers in many tropical areas, such as the West Indies, Africa, and South-east Asia.[6] By helping the disintegration of vegetative matter, carrying sub-soil to the surface and organic matter underground, and improving the soil structure by burrowing, termites can convert an otherwise poor soil into a fertile one. On the other hand, some species may reduce the soil fertility by feeding on vegetative remains that would otherwise be converted into humus, or by feeding on the humus itself.[7] In many tropical regions where the soils are infertile, termite mounds form islands of exceptionally fertile soils, and are much sought after by farmers. In the Korat Plateau of Thailand, for instance, the soil from one type of termite mound is the only medium capable of supporting upland crops. The farmers flatten the mound and spread the soil to make a large flat platform on which crops are grown.[8] In tropical Africa both fertile and infertile termite mounds are found.[9]

The very infertile soils of the tropics are usually old or mature soils which have been long exposed to continous leaching and soil impoverishment. Conversely, the fertile soils are usually young soils.[10] Soils may be kept young by two processes. Firstly, through the constant removal of the leached surface layers by

1. Wilshaw, 'Studies in Malayan Soils', pp.4-24.
2. Dennett, 'The Classification and Properties of Malayan Soils', p.358.
3. Ibid., p.357.
4. Owen, op. cit., pp.29-30.
5. 'Classification of Tropical Soils', *African Soils,* Vol. II, No. 1, 1952, pp.65-7.
6. A.M. Adamson, 'Termites and the Fertility of Soils', *Tropical Agriculture,* Vol. XX, No. 6, 1943, pp.107-9.
7. Ibid., pp.110-12.
8. Pendleton, op. cit., pp.15-41.
9. P.H. Nye, 'Some Soil-Forming Processes in the Humid Tropics, IV. The Action of the Soil Fauna', *Journal of Soil Science,* Vol. VI, 1955, pp.74-7; also Vageler, op. cit., p.131.
10. J. Thorp and M. Baldwin, 'Laterite in Relation to the Soils of the Tropics', *A.A.A.G.,* Vol. XXX, No. 3, 1940, p.181.

erosion, which exposes fresh materials containing plant nutrients. Such soil enrichment is only possible on steep slopes where erosion is sufficiently pronounced. But the erosive processes are too rapidly accelerated when the forest cover on slopes is removed, so that soils here have limited agricultural value (in Malaya, for example, agricultural development has taken place usually below the 250 foot contour). Secondly, soils may be kept young by rejuvenation. The deltaic plains of large tropical rivers are rejuvenated either occasionally or annually by overflows and floods which deposit fluvial alluvium. The fertility of this alluvium is greatly increased if it is composed of material washed down from non-tropical headwaters, as it is in the Ganges. In Malaya the river alluvium is generally more fertile than the inland residual soils. Similar enrichments occur periodically in the deltaic plains of other rivers in mainland South-east Asia, such as the Mekong, the Red River, the Menam Chao Praya, and the Irrawaddy. Also, soils may be rejuvenated through additions of volcanic material, as in Java and Sumatra.

Fertile soils are also developed from basic igneous rocks.[1] Tropical countries with active volcanoes which expel basic rocks have some of the richest tropical soils. Mohr has demonstrated the relationship between basic volcanic soils (derived from basic rock, lime, magnesia, iron, potassium, phosphoric acid) and areas of high population density in Indonesia, and the relationship between acid volcanic soils and a lower population density. Those regions that are non-volcanic have still lower population densities.[2]

Laterite. At the other end of the fertility scale are the almost completely sterile soils known as 'laterite'. The name 'laterite' has in the past been loosely used to cover that group of tropical soils now known as 'latesols'. Kellogg suggests that the former term should be limited to certain tropical soils that harden upon exposure and are then exceedingly resistant to weathering. He includes four such soil types within this category: (1) soft, mottled clays that change irreversibly to hardpans or crusts when exposed; (2) cellular or mottled hardpans and crusts; (3) concretions; and (4) consolidated concretions.[3]

Different views are held about the formation of laterite, mainly on whether it develops more readily in a constantly wet climate, or in a wet and dry climate with a fluctuating water table. But there are no doubts about its infertility. The weathering and other pedological processes involved in the development of laterite remove, or make inaccessible, nutrients necessary for plant growth.[4] The lateritic hardpan, especially where it is near or on the surface, becomes indurated and highly resistant to root penetration. Forest clearing enhances the rate of laterization by destroying the soil structure and accelerating leaching, and with indiscriminate cultivation methods the upper layers of the soil are eroded away revealing the concretionary layer which soon hardens to form a resistant pan.

Laterite is widespread enough in the tropics to constitute a serious hindrance to agriculture, especially in those areas where cultivable land is limited. It occupies large areas in India, Australia, Africa, the Amazon Valley, Brazil and

1. Crowther, op. cit., p.136.
2. E.C.J. Mohr, 'The Relation between Soil and Population Density in the Netherlands East Indies', *Comptes Rendus du Congres International de Geographie, Amsterdam, 1938*, Tome II, Sec. IIIc, pp.478-93. See also K.J. Pelzer, *Pioneer Settlement in the Asiatic Tropics* (New York, 1945), pp.185-7, and J.O.M. Broek, *Economic Development in the Netherlands East Indies* (New York, 1942), p.4.
3. Kellogg, 'Tropical Soils', pp.267-8; and Kellogg, 'Preliminary Suggestions for the Classification and Nomenclature of Great Soil Groups in Tropical and Equatorial Regions', p.79.
4. J.A. Prescott and R.L. Pendleton, 'Laterite and Lateritic Soils', *Imperial Bureau of Soil Science, Technical Communication No. 47, 1952* (Harpenden, 1952), p.41.

the Guianas.[1] In South-east Asia, laterite occurs in the north-eastern Surigao region of Mindanao, and in the low plains of Thailand and Cambodia. In Malaya the purest form of laterite is found in Malacca, where lateritic concretions, with ironstones up to 1.5 inches in diameter, form of hardpan seldom more than 12 inches below the soil surface. They are mostly developed on flat or very gently undulating land, and are sometimes exposed as a hardened slag-like mass.[2] Because of the very low fertility and the impermeability of laterite soils, agriculture is almost impossible.

In this survey of tropical soils, it is evident that soil poverty and fragility are the rule, and only in limited areas, notably in the zones of recent volcanic activity, are fertile soils to be found. In short, as Gourou points out 'tropical soils are less favourable to man than temperate soils, which are richer and more stable. A study of the composition of the two types of soil always ends in the establishment of the overwhelming superiority of the temperate over the tropical in fertile chemical elements.'[3]

The remainder of this chapter will be devoted to an examination of human responses to tropical soils, and the problems facing peasant agriculture and rural development due to the handicaps of poor soils.

HUMAN RESPONSE TO TROPICAL SOILS

The most common response to the limitations imposed by poor and fragile soils is the system of shifting agriculture practised in all tropical areas, and known by different local names such as 'milpa' in Mexico, 'conuco' in Venezuela, 'masole' in the Belgian Congo, 'chitimene' in Northern Rhodesia, 'chena' in Ceylon, 'ray' in Indo-china, 'caingin' in the Philippines, and 'ladang' in Indonesia and Malaya.[4] Though cultivation practices may vary in detail in different parts of the tropics the principle remains the same—the felling and burning of an area of forest, its subsequent abandonment after one or two harvests, and then the clearing of another piece of land elsewhere while the first cultivation patch is abandoned. The cultivator does not return to the abandoned clearing until a sufficient period of time has lapsed for the exhausted soil to have recovered. Such a system of low output is not peculiar to the tropics, but was practised in temperate lands in medieval times before it gave place to the three- or four-field system of sedentary agriculture.[5] The difference seems to be that, whereas in the temperate lands a form of shifting cultivation was common only where there were poor soils, and hence was limited in areal extent, in the tropics, because poor soils are the rule rather than the exception, shifting cultivation is the most prevalent form of agriculture.[6]

The shifting cultivation system has been evolved to meet the severe limitations of infertile soils. Land rotation enables the cultivator to tap the capital nutrient built up by the tropical forest, and this capital is subsequently rebuilt when the land is abandoned and the forest allowed to regenerate itself. Apart from tree-felling and dibbling in the seeds, little labour is involved. Fire does

1. See distribution maps of laterite in ibid., pp.9, 13 and 17.
2. Owen, op. cit., pp.35-6. Also Willimott and Buckley, op. cit., p.5.
3. Gourou, op. cit., p.24.
4. D. Whittlesey, 'Shifting Cultivation', *Economic Geography*, Vol. XII, No. 1, 1937, pp.35-52. Also Pelzer, *Pioneer Settlement in the Asiatic Tropics*, pp.16-24, 29-34.
5. E.M. Crowther, 'The Effects of Plant and Animals on Soil Fertility', *Plant and Animal Nutrition in Relation to Soil and Climatic Factors* (London, 1951), pp.397-8.
6. Gourou, op. cit., p.32, foot-note 1.

the actual work of forest clearing, and once the crops are planted little further care is needed. The soil is not mechanically disturbed by ploughs. This, in conjunction with the fact that the land is under crops for only a short period, ensures the preservation of the soil structure. Soil erosion is consequently negligible, and even on steep slopes the top soil is not washed very far away but is retained by the matted vegetation of the surrounding forest. As Jacks has said: 'It must be admitted that no agricultural system except shifting cultivation has yet been devised that will ensure lasting stability and fertility to tropical forest soils under human management.'[1] But the system works satisfactorily only if there is enough land to ensure that each abandoned clearing is allowed an adequate period of rest and regeneration. The resting period should be as long as possible in view of the extremely slow rate of regeneration of the forest climax.[2] The minimum period of fallow has been calculated at fifteen to thirty years.[3] In other words, the area of land needed to sustain a population group which depends on shifting cultivation cannot drop below a certain minimum. Otherwise the period of regeneration falls short of that necessary to rebuild the store of plant nutrients, and clearing the land again sets in motion a cycle of degenerative changes culminating in the loss of mineral plant foods, the oxidation and disappearance of organic matter, the breakdown of soil structure, the degeneration of vegetation, and the destruction of hitherto stable land and water relationships.

Since the area of suitable land in any region is limited, the factor which decides its relative availability or scarcity is the number of people within that region. For the system of shifting cultivation, as for any given agricultural system, there is a limit to the number of people which the land can support without initiating the process of land degradation. This limit is called the 'carrying capacity of the land'.[4] Because it depends on land rotation rather than crop rotation, the land carrying capacity under shifting cultivation is necessarily very low as compared with any sedentary agricultural system. The exact density of population which can be supported depends upon: variations in cultivation techniques, such as the length of fallow; variations in physical conditions, such as slope, soil fertility and rainfall; and the number and yield of crops taken from each clearing. Table 24 gives rough estimates of the land carrying capacity in different parts of the tropics. The highest estimates are for the rainforest regions of Nigeria, Java, and Trengganu. In Trengganu shifting cultivation is carried on by Malays, and is confined to the flat land bordering the larger rivers where soil erosion is reduced to a minimum. In the highlands where the Aborigines have their ladangs, the pronounced slopes greatly reduce the land carrying capacity, and the figure of 160 persons per square mile for Trengganu is almost certainly never approached in the uplands of Malaya. Yet even the highest estimates are very low compared with that under such crops as wet-padi. Assuming that 2.5 to 3 acres of padi-land can support a family of four, the critical density of land under padi would be from 800 to 850 persons per square mile. For example,

1. Jacks and Whyte, op. cit., p.103.
2. For instance, it took 500 to 600 years for the forests of Ankor Wat in Cambodia to reach their present near-climax state; see P.W. Richards, op. cit., p.400.
3. Gourou (op. cit., p.31) considers that a minimum of twenty-five to thirty years fallow is necessary for the forest to build up its lost fertility. In an experiment in the Belgian Congo the maximum accumulation of leaf and litter residues was reached after eight to twelve years of fallow; see also N.V. Bartholomew and Others. 'The Immobilization of Mineral Nutrients in Tropical Soils', *Nature,* Vol. 174, No. 4418, 1954, p.24.
4. W. Allan, *Studies in African Land Usage in Northern Rhodesia* (Oxford, 1949), p.1.

in the most densely populated padi district of Kota Bharu in Kelantan, the population density in 1947 was 666 per square mile.[1]

TABLE 24: LAND CARRYING CAPACITY UNDER SHIFTING CULTIVATION IN THE TROPICS

TERRITORY	LAND CARRYING CAPACITY, PERSONS PER SQUARE MILE
NORTHERN RHODESIA	25 TO 100
BECHUANALAND (TATI NATIVE RESERVE)	26
NIGERIA: NORTHERN PROVINCES	144
SOUTHERN PROVINCES	88
CEYLON	81
JAVA	130
SUMATRA	30
BRUNEI	18 TO 64
MALAYA (TRENGGANU)	160
BRITISH HONDURAS	60

Sources:

Northern Rhodesia: Allan, op. cit., p. 40.

Bechuanaland: ibid., p. 20.

Nigeria: L.D. Stamp, 'Land Utilization and Soil Erosion in Nigeria', *Geographical Review*, Vol. XXVIII, No. 1, 1938, p. 35.

Ceylon: 'Agriculture and Population Density', *Tropical Agriculturist*, Vol. CV, No. 1, 1949, pp. 1-3.

Java: van Beukering cited by Pelzer, *Pioneer Settlement in the Asiatic Tropics*, p. 23.

Sumatra: Gourou, op. cit., p.38.

Malaya and Brunei: D.B. Arnot and J.S. Smith, 'Shifting Cultivation in Brunei and Trengganu', *The Malayan Forester*, Vol. VI, 1937, pp. 13-17.

British Honduras: Charter, op. cit., p. 16.

The system of shifting cultivation will work indefinitely, without detriment to the soil, as long as the critical density of population on the land is not exceeded. However, there are now clear indications that a position is fast approaching in which this equilibrium can no longer be maintained because of the extreme pressure of the rapidly growing population on available land. According to a United Nations Report, almost all the Asian, African and Latin American countries have population growth-rates of over 2 per cent per annum.[2] Since the carrying capacity of land is very much lower under shifting cultivation than under wet-padi cultivation, the critical density will be reached sooner in areas where the former system prevails, as for example in Africa, than in those parts of the South-east Asian tropics where wet-padi forms the basis of subsistence agriculture. In fact, a population density of about 200 per square mile in a region under shifting cultivation may exert the same pressure on the land as a density of about 1,000 in an area of intensive wet-padi cultivation.[3]

1. del Tufo, op. cit., Table 4, p.137.
2. U.N. *Population Growth and the Standard of Living in Underdeveloped Countries* (New York, 1954), p.3. However, it is the considered opinion of the East African Commission that population growth-rates in Africa have been exaggerated; see *East Africa Royal Commission, 1953 to 1955 Report* (London, 1955), Cmd. 9475, pp.30-6.
3. This illustrates the dangers of using absolute population figures as an indication of 'overpopulation' or 'underpopulation'. The low overall density of population in Africa is not necessarily a sign of the continent being 'underpopulated' nor the high population density of Java of it being 'overpopulated'.

The critical densities have been reached and passed in many parts of the tropical world where shifting cultivation is practised. In Ceylon, 'chena' cultivation is confined to the Dry Zone, and population numbers here have reached the level which land under 'chena' can safely support. In many parts of the Outer Islands of Indonesia widespread soil degradation in ladang areas over the last twenty years points to the great pressure of population on the land. In tropical Africa, over the greater part of which shifting cultivation is the only form of agriculture, the limit has also been reached. Here 'during the past fifty years . . . the introduction of cash-crops, the growth of population and, where Europeans have settled, the reduction in land area available to the indigenous population, have led to a decline in the resting period of the land, and thus to soil exhaustion.'[1]

The usual response to land shortage is to reduce the length of the resting period between periods of cultivation. Where previously there was a fallow period of twenty or more years, the same piece of land would now be cleared again for cultivation after ten years or so. Consequently the natural vegetation is less and less able to regenerate itself sufficiently to restore the lost soil fertility, and crop yields begin to fall. The character of the vegetation begins to alter with the increasingly frequent interference, degenerating from secondary forest to poor scrub and bush, and later to the poorest coarse fire-resisting grasses like the *Imperata* species.

The process of vegetative degeneration is accelerated by the cultivators' habit of firing the land before planting. Fire is a useful and practical method of clearing land. Firing also gives an initial beneficial effect to the soil, which Jack states is due to a temporary increase in bacteria numbers in the soil.[2] It has also the added advantage of making the soil friable, and so renders digging unnecessary. But fire at the same time destroys a large amount of wood, leaves, and other vegetative matter which are the raw materials of humus. As the fallow period is shortened and fires repeatedly invade the same clearing, a stage will be reached when, instead of the forest trees, there will be expanses of grassland made up mainly of the obnoxious weeds—*Imperata arundinacae* and *Imperata cylindrica* ('lalang' in Malaya; 'alang-alang' in Indonesia, and 'cogon' in the Philippines). Once established, these grasses tend to exclude all other vegetation. The rhizomes of *Imperata* extend deep underground and are not affected by fires on the surface. The fires kill off other non-resistant plants but leave the grasses intact and dominant, so that the regeneration of the forest can only occur if these fires are prevented.[3] Once the vegetation has been converted to grasses and weeds, the land is almost sterile. As cattle fodder, *Imperata* grasses are of low nutritive value, and cattle suffer from scour and sore mouths when they are forced to eat them.[4] Only the young shoots are reasonably palatable. African herdsmen periodically burn the savannah to obtain a good crop of young shoots for their cattle. Land given over to *Imperata* is a good indication of past destructive agricultural practices, as well as being a sign of heavy pressure of population on the land. These grasses are common in the tropical countries.[5] In Malaya extensive lalang wastes exist in Singapore, Johore, Negri Sembilan and Malacca.

1. U.N., *Enlargement of the Exchange Economy in Tropical Africa,* p.43.
2. H.W. Jack, *Rice in Malaya* (Kuala Lumpur, 1923), p.16; also Coulter, 'Organic Matter in Malayan Soils', p.195.
3. E.J. Sturgell, 'Lalang and its Eradication', *The Malayan Forester,* Vol. III, 1934, pp.186-8.
4. *Imperata Cylindrica, Taxonomy, Distribution, Economic Significance and Control* (Oxford, 1944), pp.34-5.
5. See map of world distribution of *Imperata* spp. in ibid, p.8.

The soil exhaustion which follows when too great a strain is placed on the carrying capacity of the land also causes widespread erosion. As the Director of the Commonwealth Bureau of Soil Science has stated, 'Soil exhaustion is the root cause of nearly all the erosion that is taking place today.'[1] In Africa soil erosion has become an 'almost insuperable obstacle to development.'[2] In 1937, following a survey of land usage and soil erosion in Africa, the Royal African Society expressed the gravest concern over 'the widespread destruction of African soil by erosion consequent on wasteful methods of husbandry which strike at the basis of rural economy and Native Welfare.'[3] The same problem is met with in parts of Indonesia, where the Toradja area of South Celebes is very badly eroded, and in parts of Borneo, Sumatra and East Indonesia, where thousands of square kilometres of land are affected.[4]

It is evident that shifting cultivation, while admirably adapted to the edaphic and climatic conditions of the tropics, has already become an unsuitable agricultural system over a large part of the tropical world, because the carrying capacity of the land under this system is much too low to meet the needs of expanding populations. The primary cause is the low fertility of tropical soils. Such soils demand a form of land usage that can maintain itself without endangering either the fertility or the structure of the soil.

It is necessary then, that a sedentary farming system capable of supporting a dense and growing agricultural population, without straining the carrying capacity of the land, should be evolved. So far no solution has been found, except in the wet tropics of Asia where rice is the staple food, and wet-padi cultivation offers all the advantages of sedentary agriculture without the otherwise inevitable exhaustion of the already low soil fertility. This agricultural system will be discussed in detail in the following chapter. For the present it is proposed to examine further the problem of soil infertility and soil fragility, by analysing the methods used to overcome the handicap of infertile tropical soils.

METHODS OF OVERCOMING THE HANDICAP OF INFERTILE TROPICAL SOILS

The physical processes of soil impoverishment start with the removal of the forest cover, and the interruption of the nutrient cycle. With the planting of dry land crops there is a further decline in soil fertility because each crop removes from the soil a certain amount of nutrient vital to its growth. This amount is lost with the harvesting of the crop, especially in the case of cereals and other food-crops where the whole plant is uprooted with or after the harvest. There are several ways in which the lost fertility can be renewed, such as, by crop rotation, green manuring, mixed cropping or the direct application of fertilisers and manures.

Artificial Fertiliser Application. The use of commercial fertilisers is common in temperate farming, but there are several reasons why it is not prevalent in tropical regions. The primary one is the poverty of the tropical farmer. The farmer usually does not have the means to buy fertilisers, which have usually to be imported and are therefore expensive. The general situation as regards fertiliser

1. Quoted in *West Africa,* 16th October, 1948, p.1058.
2. Jacks and Whyte, op. cit., p.247.
3. 'Land Usage and Soil Erosion in Africa', *Jrn. Roy. Afr. Soc.,* Vol. XXXVII, No. 146 (Supplement, 1938), p.3.
4. J.H. de Haan, 'Progress in Shifting Agriculture in Indonesia', *Transactions of the Fourth International Congress of Soil Science, 1950,* Vol. I, pp.314-15.

consumption in the different parts of the world is set out in Fig. 22. The very high level of consumption in North America and Europe stands out in marked contrast to the position in the rest of the world. In the West Indies the annual consumption in pre-war years was less than one tenth of the estimated requirements.[1] In Africa, the striking feature of land-use is 'the extremely small consumption of artificial fertilisers.'[2] In South-east Asia, fertilisers are beyond the reach of nearly all the peasants. In Java less than 1 per cent of the total cultivated area received any fertiliser at all in 1939.[3] In Malaya the cost of artificial fertilisers is much too high for most of the peasant farmers even though part of it is subsidised by the Government.[4]

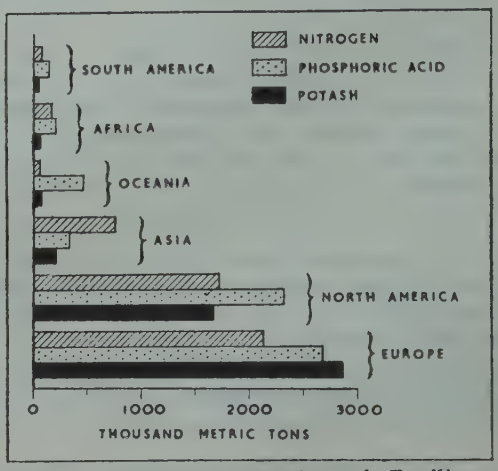

Fig. 22. World Consumption of Fertilisers, 1952-53.
Source: F.A.O., *An Annual Review of World Production and Consumption of Fertilisers, 1954* (Rome, 1954), Fig. 3, p.58.

The second reason is that even if fertilisers were made more easily available, it is doubtful if a naturally conservative peasantry would adopt this means of replenishing soil fertility. In Malaya, although striking responses in yield were obtained through fertiliser application on the east coast padi areas, and fertilisers were heavily subsidised by the Government, only 296 tons were bought by the peasants in 1954. This was enough to manure 2,960 acres, or 2 per cent, of the total planted padi area. One of the reasons given was the still considerable feeling of reserve with which fertilisers were regarded.[5]

Thirdly, the favourable response of tropical soils to artificial fertilisers has yet to be established. Most tropical soils when exposed to prolonged leaching become seriously depleted of phosphorus. Experiments on the application of phosphate fertilisers to many of these soils have been successful.[6] But it has been observed that some tropical soils have a peculiar capacity for immobilizing phosphate when it is applied as a fertiliser, that is, of converting the phosphate into forms which cannot be taken up by plants. In Malaya, where soils are markedly deficient in phosphate, phosphatic fertilisers when applied to rubber areas did not give the response anticipated due to what has been termed 'phosphate fixation'. Less than 2 per cent of the fertilisers added remained in the soluble state available to plants, as compared with 20 per cent in temperate soils. The

1. Hardy, 'Soil Productivity in the British Caribbean Region', p.21.
2. H. Greene, 'Soil Conservation in British Colonial Africa', *African Soils*, Vol. I, No. 1, 1951, p.15.
3. Pelzer, *Pioneer Settlement in the Asiatic Tropics*, p.51.
4. *Report of the Rice Production Committee* (Kuala Lumpur, 1953), Vol. I, pp.28-9. Local sources of fertiliser are unimportant in Malaya; see 'Local Fertilisers and their Uses', *M.A.J.*, Vol. XX, No. 3, 1932, pp.113-17.
5. Heath, op. cit., p.69.
6. A. Demslon, *Proceedings of the First Commonwealth Conference on Tropical and Sub-Tropical Soils, 1948*, p.178.

remainder was immobilized. Abnormally large quantities of fertilisers have therefore to be used in order to provide adequate supplies of phosphate.[1]

The use of artificial fertilisers is not likely to become a practical solution to soil impoverishment in most tropical countries for a long time.

Organic Manure Application. Another important method of improving soil fertility is by the use of organic manures. In some instances soils which do not respond to artificial fertilisers are able to produce good crops when organic manures are applied.[2] Composting is practised in India and Africa. In India the 'Indore' process of composting was developed by Sir Albert Howard. In this process a mixture of organic waste material and earth was converted into a finely divided humus rich in plant food.[3] The main disadvantage of the 'Indore' process is the need for a considerable amount of labour and care in carrying out the routine preparations.

Composting finds its best development in the traditional Chinese method of using household refuse, vegetable waste and animal or human excreta for making manure. This method is practised by Chinese farmers wherever they have settled, and appears to be as suited to the tropics as to the more temperate regions where it was evolved. In Malaya, for example, the Chinese market-gardeners have succeeded in converting almost sterile land, such as mined land, into flourishing farms through the use of this kind of manure. The gardeners who settle on the old tin tailings in the Kinta Valley have to start off with a soil which has no nutrient content, and which provides little more than the physical medium for holding plant roots upright. The usual process of reclamation consists of a preliminary planting of green manure which is later dug in. Most of the land is then planted with sweet potatoes and other vegetables—beans, chilies, groundnuts, leafy vegetables, marrows, gourds and cucumbers. Next to the farmer's hut is a pig pen. The pigs are fed on mash prepared from vegetable waste, chopped banana tree trunks and cooked water-hyacinths. Pig droppings are collected in a tank and used for manuring the vegetables. Sometimes human excreta is also mixed in. A pig-vegetable cycle is thus established, and the symbiosis of soil, plant, and animal is so balanced that the whole system can be carried on for an apparently unlimited period of time without causing soil deterioration.[4]

However, this form of farming and manuring is only practised on a large scale by Chinese immigrants in the tropics. The Chinese in South-east Asia, with their tendency to form closed communities, have had little effect on local institutions and culture, and they have not modified indigenous agriculture to any great extent. In Malaya, religious antipathies prevent the Malays from having anything to do with the pig, so that they would find it impossible to adopt the Chinese farming system. Because it is more suited to intensive vegetable farming, the Chinese market-gardening method of soil preservation may prove to be less valuable, or less practical, for large scale food-crop agriculture.

1. For a full discussion of this question, see G. Owen, 'Retention of Phosphates by Malayan Soils', *Journal of the R.R.I. of Malaya,* Vol. XII, Comm. 262, 1947, pp.1-46; and G. Owen, 'Studies in the Phosphate Problem in Malayan Soils', *Journal of the R.R.I. of Malaya,* Vol. XIV, Comm. 283, 1953, pp.121-32.
2. Lambourne, op. cit., pp.457-73.
3. Sir A. Daniel Hall, *The Improvement of Native Agriculture in Relation to Population and Public Health* (Oxford, 1936), pp.34-5.
4. J.M. Blaut, 'The Economic Geography of a One-Acre Farm on Singapore Island', *M.J.T.G.,* Vol. 1, 1953, pp.37-48; H.J. Simpson and Lau Sing Nam, 'Chinese Market-Gardening', *M.A.J.,* Vol. XXII, No. 3, 1934, pp.119-24; D.W. le Mare, 'Pig-rearing, Fish-farming and Vegetable-growing', *M.A.J.,* Vol. XXXV, No. 3, 1952, pp.156-66; and T.D. Marsh, 'Pigs in Malaya', *M.A.J.,* Vol. XX, No. 8, 1932, pp.392-406.

Green Manuring. Green manuring, that is, the growing of leguminous plants for ploughing under, as a method of soil enrichment is common in temperate lands, but its value for dry land crops in the hot wet tropics has not yet been proved. In view of the fact that tropical soils should be disturbed as little as possible, as each turning of the soil intensifies leaching and leads to loss of nutrients, it is doubtful if green manuring will bring any real benefit. Most peasants cannot afford to sacrifice a harvest of food-crops in order to grow green manure for ploughing under. In South-east Asia green manure is only used in padi-fields, where the natural growth of weeds and other plants during the fallow season are ploughed under and allowed to decompose under anaerobic conditions.[1]

Mixed Cropping. An agricultural practice intended to preserve soil fertility, and common to all parts of the tropics, is mixed cropping. In this system many types of crop are planted on the same piece of land at the same time. The system has some of the advantages of the crop rotation of temperate areas, especially when leguminous plants are inter-cultivated with other crops.[2] The soil nutrient supply is only slowly expended because the different crops develop unequally, and do not draw upon the nutrient supplies simultaneously or require similar kinds of nutrients. Mixed cropping is prevalent in India, America and in the South-east Asian tropics.[3] In a typical African peasant farm the food plants are generally grown in a heterogeneous mixture of maize, millets, beans, cassava, yams, potatoes and vegetables. Garden culture is a characteristic feature of most villages in Ceylon, where a great variety of plants are grown intermixed in the same plot.

Mixed gardens are found all over South-east Asia, from Burma, Thailand, Indo-china and Malaya, to Central Java and many other parts of Indonesia.[4] A mixed garden is made up of three stories or levels, the ground storey in which the low shade-loving plants (elephant yam, arrowroot, sweet potatoes, taro, beans and various types of vegetables) grow; the middle storey with taller plants (cassava, bananas, citrus fruit, and other trees of medium height); and the upper storey with tall trees (such as coconut, jackfruit, mango, durian, and tamarind).[5] As well as slowing down the rate of soil exhaustion, this system fits well into the subsistence economy of the peasants. The large number of different plants produce fruits, tubers and vegetables all through the year, and ensure the farmer of at least the minimum of food requirements for the year. The mixed garden is a well conditioned response to the character of the climate and soil in the tropics.

The 'Corridor' System of Agriculture. All the methods discussed so far, except mixed cropping, are concerned with directly replenishing soil nutrients lost during cultivation. However, where a growing population practising shifting cultivation finds itself short of land, a system must be evolved which can preserve soil fertility and at the same time support a denser population per unit area. The Belgians in the Congo are experimenting with the 'Corridor System' which they hope will solve at least one of these problems. Under this system, long

1. F.A.O., International Rice Commission, *Report of the Second Meeting of the Working Party on Fertilisers* (Rome, 1953), pp.27-8.
2. J.C. Willis, *Agriculture in the Tropics* (Cambridge, 1914), p.29.
3. H. Nicol, 'Mixed Cropping in Primitive Agriculture', *Empire Journal of Experimental Agriculture,* Vol. III, No. 10, 1935, pp.189-95.
4. G.J.A. Terra, 'Mixed Garden Horticulture in Java', *M.J.T.G.,* Vol. 3, 1954, pp.33, 39.
5. Pelzer, *Pioneer Settlement in the Asiatic Tropics,* pp.43-4; also Terra, op. cit., pp.36-8.

galleries, a hundred metres wide, are cut out of the rainforest. Mixed cropping as well as crop rotation are practised on the land so cleared, and protection against the sun's rays is obtained by close sowing of a more luxuriant plant growth and by cover crops. The proximity of the forest affords easy re-afforestation, and the system itself is easily understood by primitive agriculturists, so that there is a minimum of clash with tribal customs. A modification of this system has also been evolved for the hilly areas in the Ruizzi Valley of the Congo. Under this system, instead of a long strip, several strips and blocks of land are occupied depending on soil and topographical conditions. The land is held under communal tenure, and in 1952 there were 750 farms and a dozen villages covering 52,000 hectares.[1]

The 'Corridor' and related systems are basically similar to the age old practice of shifting cultivation in which the soil fertility is preserved by land rotation. They do not, however, solve the problem of land shortage, and the carrying capacity of the land is not greatly increased.

Mixed Farming. In many parts of the tropics, and especially in Africa, experiments are being conducted on the suitability of mixed farming as a substitute for shifting cultivation. The basis of this type of farming is the manuring of arable land with farmyard manure made by cattle at night on bedding. The land is devoted to grazing and the production of grain, vegetables and cash-crops.[2] Sir Frank Stockdale has recommended the introduction of mixed farming into Malayan peasant agriculture.[3] But the system has more often been advocated for Africa because of the separation of the pastoral and agricultural economies there.

Cattle in Africa, however, are not thought of in terms of providing labour and as another economic unit, but play an extremely important part in the socio-religious affairs of the pastoral tribes. Cattle constitute the chief form of dowry paid for a wife, and the whole social structure rests on cattle. They are living symbols of wealth and prestige. Promiscuous breeding is therefore encouraged, the main consideration being quantity rather than quality. With the increase in the number of cattle, pastures become scarce and overgrazed so that the soil degradation problem is accentuated.[4]

There are also other difficulties in introducing mixed farming to Africans. In most cases the peasant has to be taught the use of the cattle drawn plough, and the cattle themselves are usually in a poor condition and unfit for work. Pastoral tribes despise agriculture, and to get them to settle down on a piece of land growing crops and fitting their cattle into the new system is extremely difficult.[5] In Northern Nigeria, however, experiments at developing a system of permanent farming whereby a peasant, with a few head of cattle, can plough and maintain a piece of land, and grow enough for himself and his family as well as

1. F. Jurion, 'Soil Conservation in the Belgian Congo', *African Soils,* Vol. I, No. 1, 1951, p.37; and J.H. de Haan, 'The F.A.O. Regional Meeting on Land Utilization', *African Soils,* Vol. II, No. 2, 1952, p.251.
2. O.T. Faulkner, 'Mixed Farming in the Tropics: a Definition of the Term', *Tropical Agriculture,* Vol. XIX, No. 1, 1942, pp.17-19; also A.E. Haarer, 'Farming Humus in Tropical Soils', *The Crown Colonist,* Vol. XX, No. 224, 1950, p.411.
3. Sir Frank Stockdale, *Report on a Visit to Malaya, Java, Sumatra, and Ceylon, 1938* (London, 1939), pp.65-6.
4. C. Maher, 'A Note on the Economic and Social Problems in Kenya and their Relationship to Soil Erosion', *International Institute of Political and Social Sciences, Record of the Twenty-Fifth Meeting* (Bruxelles, 1950), pp.63-72.
5. Hailey, op. cit., p.972.

leave a small saleable surplus without 'mining' the soil, appear to be very promising.[1]

Apart from these human factors, available evidence indicates that the tropical environment is not suited to livestock rearing. The hot wet climate induces hyperthermy in cattle and causes them lose their appetite.[2] Attempts to introduce cattle from temperate countries have failed because of the low powers of adaptibility of the non-tropical breeds to the climate.[3] Improvement in quality is only possible through judicious selection among indigenous species, and the high standard and quality of animals of the temperate countries can never be achieved in the tropics.[4] The prevalence of animal diseases is also against cattle raising. In Africa, for example, the tsetse fly takes a heavy toll of animals each year.[5]

The greatest problem lies in the difficulty, if not the impossibility, of maintaining nutritious pastures for the cattle. This is because the climax vegetation in the hot wet tropics is rainforest rather than grass. Tropical pastures are of poor nutritive value. The leguminous plants of the temperate lands (such as alfalfa and clover) are absent, partly because of the low humus content of tropical soils. It has also been established that the higher rate of photosynthesis under tropical conditions tends to produce rapidly growing herbage with low protein and mineral content.[6] For example, it was found that cattle in tropical Australia did not thrive because the nutritive value of the feed was very low, especially in protein. The protein content of the grasses was still lower in the regions of higher rainfall in Queensland and the Northern Territory.[7]

The poor quality of tropical pastures causes the cattle to grow very slowly (in Malaya the growth rate is half that in Great Britain), and a greater area of land is needed to provide for them.[8] Gourou states that an acre of pasturage in the tropics can feed only one tenth the live weight that a similar area in Europe can support.[9] Good pastures in the tropics are able to support, with the help of

1. O.T. Faulkner and J.R. Mackie, 'The Introduction of Mixed Farming in Northern Nigeria', *Empire Journal of Experimental Agriculture,* Vol. IV, No. 13, 1936, pp.89-96; J.G.M. King, 'Mixed Farming in Northern Nigeria,' *Empire Journal of Experimental Agriculture,* Vol. VII, No. 27-8, 1939, pp.271-98; and O.T. Faulkner and J.R. Mackie, *West African Agriculture* (Cambridge, 1933), pp.64-75.
2. J.C. Bonsma, 'Ecological Animal Husbandry Research and its Application in Maintaining a Permanent Pastoral Industry', *Plant and Animal Nutrition in Relation to Soil and Climatic Factors* (London, 1951), pp.364-81.
3. J.M. Joubert, 'Breeding for Beef in Tropical and Sub-tropical Climates, with Special Reference to the Continent of Africa', *Colonial Plant and Animal Products,* Vol. IV, 1954, pp.9-12.
4. 'Breeding for Beef in Tropical and Sub-tropical Climates', *Nature,* Vol. 174, No. 4438, pp.915-16.
5. F.A.O., *Improving Livestock under Tropical and Sub-tropical Conditions* (Washington, 1950), p.30; also J. Smith, 'The Combating of Animal Diseases and the Improvement of Stock in Empire Countries', *Empire Journal of Experimental Agriculture,* Vol. V, No. 17, 1937, pp.11-18.
6. H.C. Trumble, 'Climatic Factors and the Nutrition of Herbage Plants', *Plant and Animal Nutrition in Relation to Soil and Climatic Factors,* pp.1-9; H.R. Marston, 'The Influence of Climate and Terrain on the Nutrition of Grazing Ruminants', ibid., p.249; and K.C. Hamner, 'The Influence of Climatic Factors on Mineral and Vitamin Content of Plants', ibid., pp.220-25.
7. C.S. Christian and N.H. Shaw, 'Protein Status of Australian Tropical and Sub-Tropical Pastures', *ibid.,* pp.225-33.
8. R. Henderson, 'The Cultivation of Fodder Grasses in Malaya', *M.A.J.,* Vol. XXXVIII, No. 2, 1955, p.71.
9. Gourou, op. cit., p.54.

cultivated herbage, one head per three acres, whilst poor pastures support only eight head per 1,000 acres. In the Belgian Congo, where large expanses of savannah are composed of grasses with very little nutritive value, it takes at least twenty-five acres of natural pastures to maintain a single cow.[1]

Conditions in Malaya are also not suited to grasses.[2] The lalang (*Imperata* spp.), which has sprung up in forest clearings and in abandoned agricultural and mining land, is of low nutritive value. Cattle rearing 'on a national scale, as part of the agricultural practice, is conditioned by the finding of fodder crops which will grow under shade, for which there are not good prospects.'[3] There has been little work on pasture research until recently, and the general picture remains unpromising.[4] Elsewhere in South-east Asia the situation is not much different. However, it is reported that a satisfactory solution to livestock feeding in the Bangkok plain has been found. Here the problem was to provide feed for cattle during the dry season, when the better pasture grasses do not grow at all. Two fast-growing deep-rooted leguminous shrubs—*Leucaena glanca* and *Sesbania grandiflora*—have been discovered which could provide a continuous supply of feed for all forms of livestock throughout the year.[5]

From this survey it seems clear that cattle do not fit well into the tropical environment, and while the cattle disease problem may be solved in time with advances in medicine, the much more fundamental obstacle of lack of suitable pastures and fodder is only beginning to be investigated. In view of this, geographers, agriculturists and pedologists have shown scepticism over the introduction of mixed farming on a large scale in the tropics.[6] Experiments in Malaya have demonstrated that there is no real gain in mixed farming as far as soil fertility is concerned. In these experiments fodder grasses were cultivated as a first step in the establishment of a mixed farming cycle, in which grasses were to be used for feeding cattle, and the farmyard manure applied to the soil as a fertiliser for the grasses, with any surplus manure going to meet the needs of other crops. It was found that, with good cultivation and proper management, yields of nine to thirteen tons of green fodder per acre per annum could be maintained when ten to fifteen tons of manure were applied to the soil. The fodder yields were just sufficient to support one head of cattle per acre per annum. Even with a higher rate of stocking, the amount of farmyard manure produced would only be sufficient to maintain the yields of the herbage at the levels quoted, and no surplus would be available for other crops.[7]

Since the purpose for the introduction of mixed farming into the tropics is the preservation of soil fertility in permanently cultivated non-irrigated fields, it is doubtful if the constant turning of the soil when the fields are ploughed

1. H.R.F. Colbeck, 'Cattle Raising in the Belgian Congo', *Progress,* Vol. XLV, No. 248, 1955-56, pp.35-6.
2. R.E. Holttum, *Plant Life in Malaya* (London, 1954), pp.106-7.
3. T.D. Marsh and V. Dawson, 'The Improvement of Cattle and Buffaloes in Malaya', *M.A.J.,* Vol. XXXI, No. 3, 1948, pp.159-60.
4. Gunn Lay Teik, *Fodders and Feeding Stuffs in Malaya* (Johore Bahru, 1951), p.19.
5. R.L. Pendleton, 'Importance of Shrubs for Livestock Feeding in Humid Tropical Regions', *Bulletin Agricole du Congo Belge,* Vol. XL, No. 1-4, 1949, pp.1907-9.
6. Crowther, 'Soil Fertility Problems in Tropical Agriculture', p.140; Gourou, op. cit., pp.95-8; and Pelzer, *Pioneer Settlement in the Asiatic Tropics,* pp.33-4.
7. C.D.V. Georgi and Others, 'A Manurial Experiment with Merker and Napier Grasses', *M.A.J.,* Vol. XXIX, No. 8, 1941, pp.304-21. Also O.T. Faulkner, 'The Yield of Perennial Fodder Grasses in Malaya and its Implications', *Tropical Agriculture,* Vol. XIX, No. 3, 1942, pp. 51-3.

helps towards achieving this end, due to the ease with which the soil fertility and soil structure are destroyed when the land is disturbed and exposed to the sun and to the erosive force of the rains. Even if mixed farming can be developed into a satisfactory substitute for shifting cultivation, the change from shifting to sedentary agriculture involves, apart from any social upheaval, the drastic reorganization of cultivation techniques. Mere legislation forbidding the practice of shifting cultivation is insufficient and impractical, as illustrated in Malaya where, although it is illegal, 'ladang' cultivation is still practised in the interior locations remote from the developed centres.

It will be seen that rural development, and a rise in the standards of living of the agricultural population of the tropical areas, have to be achieved in the face of two serious handicaps—the low level of tropical soil fertility, and the high rates of population increase. What Joubert says of Africa can be applied to the tropical world in general, '... compared with temperate regions... productivity per unit land or beast is appreciably lower. Hence it is of prime importance to appreciate that all development of agriculture and livestock enterprise in these regions must occur strictly in accord with the predominantly poorer and more adverse environmental conditions.'[1]

So far no satisfactory alternative has been found (except in the Asian tropics where wet-padi cultivation is practised) for the now obsolete system of shifting cultivation. According to de Schlippe 'to speak about rural development in the tropics, or to envisage development of underdeveloped areas, without planning the transition from shifting to sedentary cultivation, will be equivalent to limiting one's intention to non-essentials.'[2] Normally such a transition might take a few centuries, and in seeking to telescope this process into a few years would be a formidable task, in spite of the possible advances in methods and technologies. Yet there is no other course open if the peasant cultivators are to have a higher material standard of living in place of a bare minimum subsistence.

1. Joubert, op. cit., p.12.
2. P. de Schlippe, 'Shifting Cultivation—The Key Problem of the Tropics', unpublished paper read at the Conference on Regional Planning and Development, (London, 28th September to 2nd October, 1955), p.6.

CHAPTER V

PROBLEMS OF INCREASING PADI PRODUCTION IN A TROPICAL AREA—THE EXAMPLE OF MALAYA

PADI CULTIVATION IN THE TROPICS

FOR A LONG time agriculturalists have recognized that the ideal form of agriculture in the tropics, from the ecological standpoint, is one which comes closest to duplicating the original rainforest conditions.[1] The successful agricultural undertakings in the wet tropics are, apart from wet-padi, tree crops of one kind or another—rubber, cocoa, oil-palm, coconut and others. By reproducing forest conditions a cycle of nutrients is set up between soil and tree which is perpetuated by dead vegetable matter. The soil structure is also preserved, and the erosive power of tropical rainfall reduced considerably by the protective cover of foliage and the blanket of decaying vegetation which cover the soil layers.

However, the cereal foods that make up the bulk of tropical diets are not derived from perennial tree crops but from annuals.[2] The fundamental problem of food production arises from the fact that the wet tropics are not suited to arable annual food-crop cultivation.[3] Light conditions appear to be unfavourable to cereal plant growth. For example, one of the main reasons why padi yields in Java are lower than in Italy, in spite of the same expenditure of labour and similarity in cultivation techniques, is the less favourable light conditions in the former area.[4] The cloudy skies of the wet tropics are inimical to plant growth and render plants susceptible to disease.[5] The rate of nutrient absorption by annuals differs considerably from that by perennials. A tree has a large volume of soil from which to draw its nutrients, and in the wet tropics, with their constantly high temperatures and abundant rainfall, plant food absorption can take place all year round, so that the average rate of absorption tends to be low. An annual, on the other hand, has a much smaller volume of soil from which to obtain its food, and a shorter period of time in which to do it, so that the absorption rate tends to be high. A supply of nutrients sufficient for tree growth may therefore be insufficient for the annual.[6] Because of the general low fertility of tropical soils the supply of nutrients often falls short of the requirements of the annuals. As on the non-alluvial soils of Malaya, this supply has to be

1. Sir Frank Stockdale, 'Soil Conservation in the Tropics', *Tropical Agriculture.* Vol. XVII, No. 2, 1940, p.36; also H.A. Tempany, 'Land Utilization in the Wet Tropics', *Empire Journal of Experimental Agriculture,* Vol. XVII, No. 67, 1949, pp.148-56.
2. Not all tropical diets are based on cereals. In many parts of South-east Asia, particularly in the Western Pacific islands, root crops form the food staple. Grainless agriculture is generally associated with shifting cultivation; see Pelzer, *Pioneer Settlement in the Asiatic Tropics,* pp.6-9.
3. 'Food Production in the Wet Tropics', *Tropical Agriculture,* Vol. XVII, No. 4, 1940, pp.61-2.
4. Iv.M.B. Smits, 'Economic Aspects for White Farmers in the Netherlands Indies', in *Comptes Rendus du Congres International de Geographie, Amsterdam, 1938,* Tome II, Sec. IIIc, p.330.
5. H.A. Tempany and G.E. Mann, *Principles of Tropical Agriculture* (Kuala Lumpur, 1930), p.119.
6. Vageler, op. cit., pp.224-5.

artificially increased for such annual crops as ragi (*Eleusine coracara*), gingelly (*Sesamum indicum*), maize, dry-padi, and sweet potatoes.[1]

Tree crops lock up a large quantity of plant food in their roots, trunks and leaves, but this food is eventually returned to the soil in the form of dead vegetable matter, and only the fruit (the nuts from the oil-palm tree, the pods from the cocoa tree) or the sap (from the rubber tree) are removed. The annual crops, on the other hand, are totally removed with each harvest. The stalks may be eaten by cattle which do not deposit all their droppings on the fields, or they may be burnt before the next planting. Any animal manure that may be dropped in the fields dries quickly in the sun and is soon washed or blown away. The most fertile tropical soils inevitably become progressively poorer as successive crops are planted and harvested, and in a short time, they are unable to sustain the plants without artificial manuring.[2]

According to Keen, crop yields in the tropics are adversely affected by weeds, whose roots may check the development of the roots of the crop plant.[3] The low productivity of labour in the tropics is also due, in part, to the need for frequent weeding.[4] The labour required for the cultivation of annual crops was studied in Java and Madura and compared with that in Holland. It was found that an average of 400 hours of man-labour was spent in weeding operations in the cultivation of one hectare of padi in Java and Madura, while an average of only fifty-nine hours of man-labour and two hours of horsepower were needed for weeding one hectare of annual crops in Holland.[5] In Malaya the amount of labour necessary to grow one acre of padi is shown in Fig. 23. During the 1949-50 season 219 man-hours were needed for weeding alone, which was 50 per cent of the total man-hours spent on the cultivation of each acre of padi.

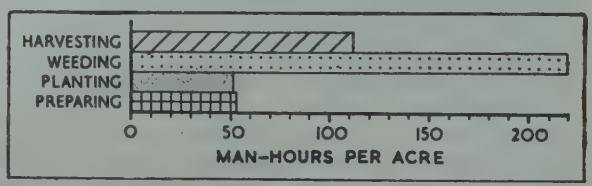

Fig. 23. Labour Required to Cultivate One Acre of Padi in Malaya, 1949-50.
Source: Allen and Haynes, op. cit., Table 1, p.67.

Of all the annuals grown in the tropics, padi, planted in flooded fields, is the only one capable of giving a good yield over an indefinite number of years without soil deterioration, and without the need for elaborate manuring. In terms of yields per man-hour of labour, padi compares favourably with other crops (including tree crops) in the tropics. Extensive research in Indonesia has shown that one hour of man-labour expended in the flooded padi-fields results in the production of 2 kilograms (approximately 4 lb.) of undecorticated rice. The corresponding returns (in kilograms) for other crops are: upland padi 1.4, maize 3.0, tobacco 1.0 to 2.0, cane sugar 1.5, tea 1.0, coffee 2.0, rubber 2.0 and pepper 2.0.[6]

The most important advantage of padi cultivation is that it overcomes to a large extent the problem of food production in the wet tropics. The soil erosion

1. W.N.C. Belgrave, 'Studies in Malayan Soils, Pt. II. Preliminary Observations on Manuring of Annuals on Inland Soils', *M.A.J.*, Vol. XXI, No. 10, 1933, pp.471, 488.
2. Vageler, op. cit., p.227.
3. Keen, op. cit., p.98.
4. See *Comptes Rendus du Congres International de Geographie, Amsterdam, 1938*, Tome II, Sec. IIIc, pp.125-30.
5. van Hall, op. cit., p.129.
6. Smits, op. cit., pp.329-30.

that usually accompanies forest clearing is prevented by the terracing, levelling and dyking necessary to maintain the padi-fields under an even layer of water. The rapid loss of soil fertility usual in dry land crop cultivation is a less serious problem in wet-padi cultivation, for three reasons. Firstly, the nutritional requirements of the padi-plants are lower than those of the other important cereals, except maize, as Table 25 illustrates. Secondly, it has been found that most of the

TABLE 25: AMOUNT OF NUTRIENTS TAKEN FROM THE SOIL BY A NORMAL CROP (IN LB. PER ACRE)

CROP	NITROGEN	PHOSPHORIC ACID	LIME	POTASH
SPRING WHEAT	110	60	50	152
SPRING BARLEY	68	63	32	74
OATS	100	62	30	104
MAIZE	52	23	22	66
MILLET	52	45	25	90
PADI	78	23	21	50

Source: E. B. Copeland, *Rice*, (London, 1924), p. 23.

nutritional requirements of the padi plant are supplied by the irrigation water and the silt carried in the water. The value of this water and silt depends upon the sources from which they are derived. River water from a young volcanic region is much richer in plant food than that from old sedimentary or granite areas. Research in Java indicated that irrigation water supplied enough of the nutritive elements, except phosphorus and nitrogen, to make up for the losses absorbed by the plants each year.[1] Van de Goor has shown that the phosphatic requirements of padi could be met by the breeding of fish in the flooded fields, the effect of which would be equivalent to the application of 80 lb. of double superphosphate per acre.[2] Thirdly, the decomposition of organic matter under anaerobic conditions is markedly slower than that under normal dry conditions. The final product of decomposition is ammonia, and the padi-plant absorbs nitrogen in the form ammonia.[3] As indicated in Table 25 nitrogen forms the largest single nutrient requirement of the padi plant. Most experts are also agreed that padi soils have the power to fix nitrogen from the atmosphere, though it is not clear how this is achieved.[4] According to recent investigations, some of the species of blue-green algae found in standing padi water have the power to fix atmospheric nitrogen. Out of 643 samples of algae collected from padi-fields in South-east Asia, thirteen species belonging to the genera *Tolypothrix, Nostoe, Schizothrix, Calothrix, Anaboenopsis* and *Plestonema* had this property, and were plentiful in tropical regions. The padi plants were able to obtain their nitrogen requirements through the help of these algae.[5] In some cases there had to be supplementary nitrogenous dressings as the algae were unable to return sufficient nitrogen to the soils, these dressings, however, seldom exceeded 48 lb. per acre.[6] The most

1. D.H. Grist, *Rice,* (London, 1953), p.172.
2. Quoted by J.G. de Gens, *Means of Increasing Rice Production* (Geneva, 1954), p.42.
3. Grist, op. cit., pp.172-4.
4. Ibid., pp.173-4.
5. A. Wanatabe, S. Nishigaki and C. Konishi, 'Effect of Nitrogen-fixing Blue-green Algae on the Growth of Rice Plants', *Nature,* Vol. 168, No. 4278, 1951, pp.748-9. Also Sir A. Howard, *An Agricultural Testament* (Oxford, 1943), p.16.
6. de Gens, op. cit., p.25.

common method of application is the working-in of plant stubble into the soil before cultivation. Green manures, especially plants of the *Crotolaria* species, are widely employed in Indo-China and Indonesia.[1] Due to the annual renewal of the fertility of padi soils by these means, tropical soils are able to maintain good yields of padi on the same piece of land for long periods of time. In the Tongking delta, padi has been grown on the same land each year for 2,000 years.[2] In Negri Sembilan (Malaya) padi-fields have been in continuous cultivation for more than 200 years without any manuring, except for the turning-in of the stubble before the season's planting.

In 1954, 93.2 per cent of the world's padi areas were in Monsoon Asia.[3] Padi is the basis of sedentary agriculture throughout the South-east Asian tropics, and rice is the main component of the peasant's diet. But, as has been shown earlier (Figs. 17 and 18), padi yields in tropical countries are much lower than those in sub-tropical and warm temperate lands. Rural development in the South-east Asian tropics depends to a large extent upon the improvement of conditions of peasant padi cultivation and upon increasing the yields. The techniques of cultivation vary in detail in different countries but the principles remain the same, and the problems of increasing yields are basically similar throughout the Asian tropics. These problems will now be discussed with reference to Malaya.

PADI CULTIVATION IN MALAYA.

Padi cultivation in the Peninsula is entirely a peasant industry, and overwhelmingly a Malay interest. The main padi areas lie north of latitude 4° 30'N. (Fig. 3). More than 70 per cent of the total production comes from two regions; the north-east coastal plains centered around the Kelantan Delta, and the north-west coastal zone running from Perlis southwards to the Krian plain of Perak. The Kelantan Delta is largely a subsistence region. A small surplus of padi from the north-west coastal zone goes to meet the rice requirements of a part of the non padi-growing population of Malaya. Of the other large deltaic plains, that of Perak is in the course of development as a colonization area. The Sungei Manik Irrigation Area has been in the process of settlement since about 1930, and the Bruas-Sitiawan plain is ear-marked as a potential padi-growing area. The other large colonization scheme—the Tanjong Karang—occupies the coastal plain to the south of the Sungei Bernam. The delta of the Sungei Pahang in eastern Malaya remains undeveloped (Fig. 1).

Another type of padi-landscape in Malaya consists of narrow valley bottoms in inland districts. They are distributed in the hill-and-valley regions of Negri Sembilan, upper Malacca, Selangor, upper Perak, Central Pahang and Trengganu. A peasant holding in these valleys is made up of padi-fields occupying the valley bottoms, and kampong land on the flanks (Fig. 13).

A third type of padi-landscape is a variation of the second, the difference being that the holdings are on both sides of the river with the houses and kampong land on the levee ridges. These holdings are found along the banks of the larger rivers, and are well exemplified by the levee landscape of the Pahang River. In places the fields and kampongs are contiguous and may stretch for several miles to form a linear belt of settlement.

1. Pelzer, *Pioneer Settlement in the Asiatic Tropics*, pp.49-50.
2. Gourou, op. cit., pp.99-100.
3. de Gens, op. cit., p.55.

The history of wet-padi cultivation in Malaya is a comparatively recent one, and this may account for the lack of adjustment of planting techniques to the Malayan environment in some parts of the Peninsula. Padi planted before the fifteenth century was almost certainly of the upland or dry variety, and was cultivated in the 'ladang' manner without the use of irrigation water.[1] Malay tradition has it that the techniques of ploughing and flooding the fields, and growing wet-padi, were introduced from Thailand into the northern Malay States during the fifteenth century.[2] The system spread slowly along the coast to the southern States during the next century.[3] From the beginning of the nineteenth century wet-padi cultivation became more and more important, but it did not entirely supersede 'ladang' cultivation until the beginning of this century, when the Government discouraged the peasants from following the latter method.[4] Today, in consequence, wet-padi is the dominant form of padi cultivation, and upland padi occupies significant areas only in Kelantan and Trengganu.[5] Table 26 summarizes the present situation. Less than 5 per cent of the total acreage in 1954-55 was devoted to dry-padi, the reminder was under wet-padi.

TABLE 26: AREA, DISTRIBUTION AND TYPES OF PADI LAND IN MALAYA, 1954-55

STATE	LAND UNDER WET-PADI (ACRES)	LAND UNDER DRY-PADI (ACRES)	TOTAL AREA	
			ACRES	PERCENTAGE
PERLIS	49,000	—	49,000	5·5
KEDAH	283,000	2,000	285,000	32·4
KELANTAN	146,000	29,000	175,000	20·0
TRENGGANU	47,000	10,000	57,000	6·5
PENANG & PROVINCE WELLESLEY	39,000	—	39,000	4·4
PERAK	110,000	4,000	114,000	13·0
SELANGOR	48,000	—	48,000	5·4
PAHANG	40,000	2,000	42,000	4·8
NEGRI SEMBILAN	31,000	—	31,000	3·5
MALACCA	31,000	—	31,000	3·5
JOHORE	9,000	—	9,000	1·0
TOTAL	833,000	47,000	880,000	100·0

Source: *Monthly Statistical Bulletin of the Federation of Malaya, Rice Supplement, 1955* (Kuala Lumpur, 1955), Tables 3A and 3B.

Experimental research, carried out by the Department of Agriculture before the war, indicated that in all the padi lands of Malaya there was a 'bar' beyond which padi yields could not be raised, in spite of liberal applications of manure

1. I.H. Burkill, *A Dictionary of the Economic Products of the Malay Peninsula, Vol. II* (London, 1935), p.1599.
2. *Federated Malay States, Report of the Rice Cultivation Committee, Vol. I* (Kuala Lumpur, 1931), p.15.
3. 'The Development of Rice Cultivation in Malaya', *M.A.J.*, Vol. XVIII, No. 11, 1940, p.472.
4. Burkill, *A Dictionary of the Economic Products of the Malay Peninsula, Vol. II*, pp.1599-1600.
5. W.A. Graham, *Kelantan: a State in the Malay Peninsula* (Glasgow, 1908), pp.71-2; J.A. Craig, 'Dry Padi in Kelantan', *M.A.J.*, Vol. XXI, No. 12, 1933, pp.664-6, and 'Agriculture in Trengganu', *M.A.J.* Vol. XXII, No. 4, 1934, pp.117-9.

and of close water control. This bar varied from 400 to 500 'gantangs' (2,200 to 3,025 lb.) per acre.[1] This maximum potential yield for Malaya is low compared with the yields obtained in non-tropical regions. Italy, for example, had an average yield in 1949-51 of about 3,750 lb. per acre, and Spain of over 4,000 lb. (Fig. 17). Yields in Australia, reputed to be the highest in the world, average 4,250 lb. per acre, and may be as high as 6,720 lb. per acre.[2]

The normal yields of padi in Malaya are far below the potential yield of up to 3,025 lb. per acre, as illustrated in Table 27. There is clearly much room

TABLE 27: PADI ACREAGE, PRODUCTION AND AVERAGE YIELD, MALAYA, 1926-54

PERIOD	ACRES	PRODUCTION (TONS)	AVERAGE YIELD (LB. PER ACRE)
1926—30 (AVERAGE)	662,000	309,000	1,046
1931—35 (,,)	740,000	509,000	1,541
1936—40 (,,)	745,000	543,000	1,633
1948—50 (,,)	865,000	575,000	1,409
1950—51	864,000	703,000	1,823
1951—52	799,000	541,000	1,518
1952—53	825,000	700,000	1,901
1953—54	835,000	647,000	1,737

Note: Acreage and average yield before 1940 are not strictly comparable with those after 1948, since the former are based on planted area while the latter are for harvested area. The difference, however, is not significantly large.

Source: *The Economic Development of Malaya*, Table 1, p. 252.

for improvement in yields, and, because of the limited acreage of undeveloped padi lands, Malaya has to depend for its food supply in the long run on increased yields from existing areas, rather than on any large scale opening up of new areas. Since padi cultivation is the main occupation of nearly two-thirds of the total peasant population in Malaya, any increase in yields would greatly benefit the peasant, especially in view of the small area planted by the individual smallholder. The average size of each holding in the different States of Malaya is shown in Table 28. The use of buffalo-drawn ploughs in Kedah and Perlis enables

TABLE 28: AVERAGE SIZE OF A PADI SMALLHOLDING IN MALAYA

STATE	SIZE (ACRES)	STATE	SIZE (ACRES)
KELANTAN	2	NEGRI SEMBILAN	3
PROV. WELLESLEY	2	PERAK (KRIAN)	4 (4)
SELANGOR	2·5	PERLIS	5 (4·1)
PAHANG	3	KEDAH	7 (4·3)
JOHORE	3	TRENGGANU	NOT AVAILABLE
MALACCA	3	AVERAGE FOR MALAYA 3·45	

Sources: Compiled from *Federated Malay States, Report of the Rice Cultivation Committee, Vol. II*, (Kuala Lumpur, 1931) App. I, pp. 7-41. Figures in brackets are from *Federation of Malaya, Final Report of the Rice Committee* (Kuala Lumpur, 1956), pp. 21-2.

1. W.N.C. Belgrave, 'Padi Manurial Experiments, 1933-34', *M.A.J.*, Vol. XXII, No. 12, 1934, p.583.
2. *Tropical Agriculturist*, Vol. CVI, No. 2, 1950, pp.82-4.

the peasant to cultivate a larger area than the average 3.5 acres. Elsewhere (except in Krian), due to the pressure of population on padi-land, the lack of suitable areas for expansion, the shortage of buffaloes, and the excessively soft nature of the soils which prevents the use of ploughs, the peasant generally cultivates less than 3.5 acres.

The discussion has so far been confined to the average yields over the whole of Malaya, but, as would be expected, there are great variations in yields from region to region and from season to season. Such variations depend upon the degree of water control, planting techniques, ravages of pests and disease, and the fertility of the soil. The crop in any one season may be totally or partially destroyed because of late planting, drought, floods or depredations by pest and disease. The consequences of the loss of a season's harvest on the peasant planter are far reaching. Although actual starvation seldom occurs, the peasant does have to find a means of maintaining himself and his family until the next harvest. The usual way out is to obtain an advance in cash or in kind, or both, from the village shopkeeper-cum-moneylender at an exorbitant rate of interest on the security of next year's crop. Since a season's harvest is barely sufficient to cover the subsistence needs of the peasant and his family there is a great difficulty in repaying even the interest accumulated on the loan, and the debt may never be repaid during the peasant's lifetime. The alternative is to increase crop productivity. The obstacles in the way of attaining this latter objective will now be examined.

PROBLEMS OF INCREASING PADI YIELDS IN MALAYA.

The maximising of crop yields depends upon the attainment of optimum levels in all the factors concerned in yield determination. Of these, some are controllable, such as water supply, cultivation techniques, planting dates, and soil-nutrient supply, whilst others are beyond control, such as climatic factors.

(1) *Climatic Factors.* Padi is grown over a wide latitudinal range—from 40°N to 40°S. Table 29 shows the average yields according to latitude (excluding the U.S.S.R.). It is evident that yields of padi grown in latitudes polewards from 20°N and 20°S are nearly double those grown equatorwards from these latitudes, and in the opinion of Grist '... while admitting that yields may be affected by local secular factors, it seems inescapable that padi is in fact better suited to the sub-tropical and warm temperate zones than to the full tropics.'[1]

TABLE 29: AVERAGE YIELD OF RICE ACCORDING TO LATITUDE

LATITUDE (DEGREES N AND S)	0 TO 10	10 TO 20	20 TO 30	OVER 30
AVERAGE YIELD (LB. PER ACRE)	824	744	1,400	1,600

Note: The yields are for husked and cleaned rice.

Source: Grist, op. cit., Table 14, p. 259.

It has been found that the higher yields of padi in the non-tropical areas are due to meteorological factors. The padi plant can tolerate temperatures ranging from 68°F to 100°F, but prolonged high temperatures have a deleterious effect on it.[2] A crop can mature only if it receives total temperatures (that is the

1. Grist, op.cit., pp.268-9.
2. E.B. Copeland, *Rice* (London, 1924), p.37.

sum of the daily mean temperatures throughout the growing season) of 3,000 to 4,000°F in the higher latitudes, and two or three times these figures in the tropical latitudes. It has been advocated that the lower temperatures in the warm temperate regions are more conducive to slower development and higher yields, while the higher temperatures in the tropics favour more rapid vegetative development but lower yields.[1] Garner and Allard have shown that the length of day and night has a marked effect upon the yield.[2] Padi requires long periods of sunshine, especially during the first two months from the date of planting, so that in the higher latitudes, as in Spain, Italy and Japan, where padi is planted during the summer, the longer days and greater duration of sunlight lead to better growth than in the low latitudes.[3] The difference in the length of day and night in warm temperate latitudes may be up to four hours, while the maximum difference in the tropics is only one hour.[4] The shorter daylight period in the tropics not only induces earlier flowering of the padi-plant but also results in a lower yield.[5] The cloudiness of tropical and especially equatorial skies is recognized as being detrimental to the padi plant, delaying its germination and increasing its susceptibility to disease.[6] The equatorial regions are characterized by a more or less permanent cloud belt and cloudless days are rare. The average cloudiness over the land is 5.2 hours per day in the zone between the equator and 10°N, and 5.6 hours per day in the zone between the equator and 10°S. Cloudiness decreases towards the higher latitudes, reaching a minimum near the Tropics of Cancer and Capricorn.[7] In Malaya most of the varieties of padi commonly grown are extremely sensitive to variations in the length of the day, even though such variations are small.[8] In Singapore (1°20′N) for instance, the difference between the length of the longest and shortest days is only about 9 minutes, in Penang (5°20′N) it is 35.5 minutes.[9] Because of its extreme sensitivity to the length of the day, the padi plant does not grow well in the southern part of the Peninsula.[10] The constant high humidity is also unfavourable to high padi yields.[11]

Climatic conditions in Malaya and other tropical areas are, on the whole, not favourable to padi cultivation. The varieties of padi grown in the tropical latitudes belong collectively to the group known as *O. sativa var. indica,* as distinct from *O. sativa var. japonica,* which thrives in warm temperate regions.[12] Although the *indica* species tolerate the less favourable climatic conditions of the tropics

1. K. Ramiah, 'Factors Affecting Rice Production,' *F.A.O. Development Paper No. 45* (Rome, 1954), pp.3-4; and de Gens, op. cit., p.16.
2. W.W. Garner and H.A. Allard, 'Effect of the Relative Length of Day and Night and Other Factors of the Environment on Growth and Reproduction in Plants', *Journal of Agricultural Research,* Vol. XVIII, No. 11, 1920, pp.553-606.
3. Grist, op. cit., p.7.
4. Ramiah, op. cit., p.4.
5. H.M. Beachell, 'Effect of Photoperiod in Rice Varieties Grown in the Field', *Journal of Agricultural Research,* Vol. LXVI, No. 9, 1943, pp.325-40.
6. H.A. Tempany and G.E. Mann, op. cit., p.119; and Copeland, op. cit., pp.16-17.
7. C.E.P. Brooks, 'The Mean Cloudiness over the Earth', *Mem. Roy. Met. Soc.,* Vol. I, No. 10, 1927, pp.127-38.
8. R.B. Jagoe, 'Photoperiodism of *Oryza Sativa* in Malaya', *M.A.J.,* Vol. XXXV, No. 2, 1952, pp.85-102.
9. H. Marriott, 'Time of Sunrise and Sunset at Singapore and Penang throughout the Year', *J.S.B.R.A.S.,* No. 79, 1918, p.101.
10. T.A. Buckley, 'Improvement of Rice Yields in Malaya by the Use of Fertilisers', *M.A.J.,* Vol. XXXIV, No. 3, 1951, p.119.
11. Copeland, op. cit., p.41.
12. Ramiah, op. cit., p.7.

and are hardier and more resistant generally, they nevertheless, give much lower yields than the *japonica* species.[1]

(2) *Water Control.* Of all the factors that determine yields, water supply is perhaps the most important. The distinguishing feature of padi is the fact that the plant grows in a field of standing water. Within the tropics, yields are higher in artificially irrigated lands than in lands which depend directly on rainfall for the water supply.[2] The primary need of lowland padi is a large and assured supply of water during the greater part of the growing season. The actual quantity of water needed varies with the soil characteristics, the evaporation rate,[3] the variety of seed, the length of the irrigation period, the method of planting and the level of the water-table. The minimum quantity necessary has been estimated at 10,000 cubic meters per hectare of planted land (143,000 cubic feet per acre). About two inches of water are needed immediately after transplanting to check weed growth. The water-level is increased later to four inches and, in the final stages of maturation, to about eight inches.[4]

The yield of padi also depends on the quality of the water, which may have a fertilising value or contain poisonous substances. In Malaya it has been found that padi will not grow in silty water contaminated by mining effluent, and areas of otherwise good padi land have to be abandoned because of contamination.[5]

Drainage is as important as irrigation in padi-growing. Excess water has to be drained from the fields if the grains are to ripen properly. Successful padi cultivation depends on the provision of facilities for getting rid of unwanted water which may result from unusually heavy rainfall and floods, or the encroachment and infiltration of water from nearby swamps. In Malaya the proximity of padi lands to the sea requires the construction of coastal bunds to prevent the ingress of sea water.[6] Lack of drainage in peaty lands causes the soils to become water-logged and excessively sour. Padi planted here cannot retain a firm hold on the soil and the plants are liable to fall with the first heavy storm, especially after they have flowered.[7] A period of drainage between the harvest and the next planting is essential for soil aeration. Drainage has also an effect on the nitrogen supply of the soil. In soils which are adequately drained the nitrogen released by anaerobic decomposition is available to the growing plants during the early and middle stages of growth, when it is most needed. In poorly drained soils, however, the nitrogen becomes available only late in the growing season, resulting in grain-lodging, late ripening and susceptibility to disease. Because of these

1. de Gens, op. cit., p.12.
2. Ramiah, op. cit., pp.10-11. One reason for this is the cloudiness which accompanies rainfall and which tends to inhibit plant growth; see Copeland, op. cit., p.42.
3. The loss of water through evaporation can be very great under tropical conditions. In Malaya, for example, 56.54 inches of water are lost per annum. The rate of evaporation remains constant and does not depend on rainfall, so that in those areas which are entirely rain fed, the quantity of water available for padi depends on the amount of water in excess of evaporation. Where rainfall in a year happens to be particularly low, the quantity remaining after evaporation may be insufficient to meet the needs of the plant, and the crop may fail due to 'drought'. H.W. Jacob and R.B. Jagoe, 'Evaporation in the Rice Fields', *M.A.J.*, Vol. XVI, No. 11, 1928, pp.381-5.
4. de Gens, op. cit., p.17.
5. D.H. Grist, 'Wet Padi Planting in Negri Sembilan', *Federated Malay States, Department of Agriculture Bulletin No. 33* (Kuala Lumpur, 1922), p.8.
6. D.S. Ferguson, 'The Construction of Coastal Bunds in Malaya', *M.A.J.*, Vol. XXXIV, No. 1, 1951, p.3.
7. H.C. Pratt, 'Padi Cultivation in Krian', *Federated Malay States, Department of Agriculture Bulletin No. 12* (Kuala Lumpur, 1911), pp.2, 10.

factors drainage is as necessary as irrigation, and lack of it at the appropriate time causes reduced yields.[1]

In those parts of South-east Asia where the padi plant is dependent upon rainfall for its water requirements, the peasant farmer is entirely at the mercy of the vagaries of the climate. In the Philippines, for instance, more than 45 per cent of the total padi lands in 1939 depended upon direct rainfall, and a shortage of rain during the critical months of May, June and October may partially or totally destroy the crop.[2] In Cambodia 80 per cent of the total padi area of 1,452,000 hectares in 1953 was rain fed, and the greatest single problem the peasants had to face was water. There were crop yield differences of 100 per cent from one year to the next because of water supply problems.[3] In Vietnam lack of water and inadequate drainage limit yields and production.[4] In Thailand the success or failure of the padi crop depends upon the height of the flood waters from the Menam Chao Praya, and the chances of getting a good crop are one in three.[5] Rainfall must not only be adequate, but its distribution over the year must be right. Planting was often delayed in the lower reaches of the padi plains of Burma, Thailand and Indo-China because of too much or too little rainfall during the critical period, tillering was consequently inhibited and yields were low.[6]

The Malay padi-planters in historical times used various ingenious means of regulating the water supply. The most usual system was, in the case of fields bordering streams, to raise the water level of the stream by means of dams constructed of brushwood, tree trunks, bamboos and boulders. Though made with great expenditure of labour, they were small and weak, and often broke at a critical period and ruined the crop.[7] Where the river was fairly large, and the banks too high to permit dam construction, water-wheels were used to lift the water to the fields on one or both banks. The water was conducted by troughs from the wheel to the fields, but the wheel itself could not rise or fall with the river level, and was easily destroyed by floods. They were capable of lifting 1,500 gallons of water per hour, sufficient to irrigate three acres of land.[8] In the largest rivers with well developed levees, such as the Perak and Pahang rivers, irrigation by gravitation presented considerable difficulties as the river levels in many parts were much lower than the levels of the fields, and the levees were too high to permit the efficient working of the water-wheel. In swamps and other water-logged areas, the peasant was entirely dependent on local rainfall, and the area that he was able to plant each year varied with the amount and distribution of the rainfall in that season.[9]

The development of modern methods of water control based on concrete reservoirs, dams, weirs, canals, pumps, and so forth, began in Malaya soon after

1. de Gens, op. cit., p.20.
2. Pelzer, *Pioneer Settlement in the Asiatic Tropics*, pp.52-4. For a more recent account of the problems of water supply in the Philippines, see J.E. Spencer, *Land and People in the Philippines* (Los Angeles, 1952), pp.153-7.
3. F.A.O., *International Rice Commission, Report of the Third Meeting of the Working Party on Fertilisers, Bangkok, Thailand, 1953* (Rome, 1953), p.34.
4. Ibid., p.45.
5. Pelzer, *Pioneer Settlement in the Asiatic Tropics*, pp.59.60.
6. Ramiah, op. cit., p.10.
7. Grist, 'Wet Padi Planting in Negri Sembilan', pp.9-10.
8. Jack, op. cit., pp.7-9; and Grist, 'Wet Planting in Negri Sembilan', p.11.
9. 'Padi Planting Methods in Malaya', *M.A.J.*, Vol. XXVII, No. 2, 1939, p.41.

the establishment of British rule, when the Krian Irrigation Scheme was instituted.[1] This Scheme was completed in 1906, and it brought adequate water control to 56,000 acres of land on the north-west coast of Perak. But no further water control schemes were initiated for the next twenty-five years, as both personnel and funds for such work were limited.

The Great Depression of the nineteen-thirties revived Governmental interest in the possibilities of increasing the home production of rice. A Rice Investigation Committee was set up, and it presented its report in 1931. It found that the chief need of the padi cultivators in all the States was for better water control in their fields, and pointed out that, apart from the Krian Irrigation Scheme, no large-scale facilities existed for irrigation or drainage in any State.[2] In the Federated Malay States the Hydraulic Branch of the Public Works Department had charge of irrigation works, but there was no similar department in the Straits Settlements. The Committee stated that the work of water control should be on a pan-Malayan and not on a State basis,[3] and accordingly recommended that 'an Irrigation and Drainage Department should be established which should be executive in the Straits Settlements and the Federated Malay States, and advisory in the Unfederated Malay States which will absorb the existing Hydraulic Branch of the Public Works Department, Federated Malay States.'[4] The new department, called the Drainage and Irrigation Department (D.I.D.), was formed in 1932.

Between its formation and the outbreak of the war, the Drainage and Irrigation Department set about restoring the padi-lands that had been abandoned because of silting, and initiated a number of projects designed to prevent further silting and flooding. The Department found padi-lands along the west coast going out of cultivation because of lack of water control. In Province Wellesley and Penang, 40,000 acres of land directly dependent upon rainfall were producing decreasing yields because the drainage canals were silted up. In the Malacca River valley, about 7,000 acres of land had been abandoned due to river silting caused by soil erosion. Indiscriminate mining practices, and the discharge of tailings from tin-mines along the Kinta Valley, had resulted in the flooding and silting up of padi areas in the lower reaches of the Kinta and Perak Rivers. All the damage accumulated from earlier years had to be repaired and the padi areas restored wherever possible. The river channels had to be cleared to prevent further silting and flooding. Discharge of tailings from tin-mines had to be controlled by silt-retention works.

The Drainage and Irrigation Department at the same time initiated the development of two large padi settlement schemes—the Pachang Bedina Scheme in Selangor, and the Sungei Manik Scheme in the lower Perak River delta. A number of small riverine areas were also provided with proper water control. In the ten years of its existence up to the Japanese invasion, the Drainage and Irrigation Department provided improved methods of drainage and irrigation to some 120,000 acres of existing padi-land, and opened up an additional 53,000

1. A.S. Haynes, 'Extension of Rice Cultivation in the Federated Malay States: Need for a Definite Policy', *Proceedings of the Federal Council of the F.M.S., 1933* (Kuala Lumpur, 1934), pp.C288-90.
2. *Federated Malay States, Report of the Rice Cultivation Committee, Vol II* (Kuala Lumpur, 1931), pp.1-14.
3. *Report of the Rice Cultivation Committee, Vol. I*, p.26.
4. Ibid., p.3.

acres of hitherto undeveloped land. Altogether 23 per cent of the total padi area of 743,000 acres in 1940-41 was given some degree of water control.[1]

Considerable damage to irrigation and drainage works occurred during the Japanese occupation. The Drainage and Irrigation Department had to repair this damage, and at the same time increase the tempo of its activities because of the severe shortage of rice in the post-war period.[2] The padi acreage in the 1947-48 season had increased to 803,000 acres, but only 237,000 acres, or 30 per cent, were provided with proper drainage and irrigation facilities.[3] Between 1949 and 1954 the area with modern water control facilities was estimated at 310,000 acres (consisting of 250,000 acres of existing padi-land and 60,000 acres of newly developed land), or 37 per cent of the total padi acreage of 846,000 acres.[4]

The need for water control in the padi areas of Malaya is still serious. Damage to crops because of floods or drought is common in those areas without a controlled water supply. It is estimated that an increase in yield of at least 25 per cent can be achieved in Malaya by means of further water control facilities. In Province Wellesley, for example, the average yield per acre in the Northern District where there was no water control in 1948 was only 528 lb., in contrast to the yield of 2,007 lb. per acre in those areas with water control.[5] The position is worst in Kelantan, the State with the second largest area under padi in Malaya (146,000 acres of wet-padi and 29,000 acres of dry-padi). Farmers here depend upon direct rainfall rather than upon the Kelantan River for their water supply. Field sites are on the lowest level ground, in the hollows between ridges, in the 'alors' or old river courses, in the distributries, and in the 'barohs' or old lagoons.[6] A minimum of 10 inches of rain in October is necessary for successful padi growth, but rainfall statistics over the past forty years indicate that the October rains have failed to attain this critical level in eighteen of the years.[7] The chances of successful padi-planting in any one year are thus just over half the chances of a crop failure. In 1946 there were twenty-two headworks, of a permanent or semi-permanent nature, providing some sort of water control for less than 20,000 acres of land. There were no extensive irrigated areas similar to those in Krian or Sungei Manik.[8] Much of the acreage planted to dry-padi each year could be converted, if there had been a controlled water supply, into wet-padi land, and yields increased by at least 100 per cent.[9] The situation in the riverine plains of Kuala Trengganu and the other main padi areas of Trengganu is as bad as that in Kelantan.[10]

1. *Annual Reports of the D.I.D. of the F.M.S. and S.S. for the years 1932 to 1938*, passim; *Federated Malay States, Report on the Progress of Schemes for the Improvement and Extension of Rice Cultivation* (Kuala Lumpur, 1935), passim; *Annual Report of the D.I.D. of the Malayan Union, 1946* (Kuala Lumpur, 1948), pp.1-21; H.L. Barnett, 'Rice in Malaya, Season 1947-48', *M.A.J.*, Vol. XXXII, No. 1, 1949, Table VI, p.11.
2. *Annual Report of the D.I.D. of the Malayan Union, 1946*, pp.22-30.
3. *Federation of Malaya, Annual Report of the D.I.D., 1948* (Kuala Lumpur, 1949), p.6.
4. Heath, op. cit., App. I, p.82; and *The Economic Development of Malaya*, p.296.
5. *Federation of Malaya, Annual Report of the D.I.D. 1948*, p.6.
6. E.H.G. Dobby, 'The Kelantan Delta', *Geographical Review*, Vol. XLI, No. 2, 1951, pp.229-33. H.K. Ashby, 'Wet Padi Mechanical Cultivation Experiments in Kelantan, Season 1948-49', *M.A.J.*, Vol. XXXII, No. 3, 1949, p.152.
7. Dobby, 'The Kelantan Delta', p.236.
8. *Annual Report of the D.I.D. of the Malayan Union, 1946*, p.81.
9. H.K. Ashby, 'Dry Padi Mechanical Cultivation Experiments, Kelantan, Season 1948-49', *M.A.J.*, Vol. XXXII, No. 3, 1949, p.170.
10. *Annual Report of the D.I.D. of the Malayan Union, 1946*, p.84.

The Government Committee, appointed in 1952 'to consider ways and means whereby the acreage planted under padi in the Federation, and the yield per acre can be materially increased within the next three years', found that the problem common to all the eleven States was lack of a regulated water supply,[1] and in 'very few areas have the irrigation works more than a supplementary effect by conserving and distributing water from rainfall'.[2] The immediate difficulties facing the extension of water control were shortage of skilled staff and of equipment.

The programme of the Drainage and Irrigation Department for the period 1955-59 included the execution of thirty-four irrigation projects, which would affect an estimated 206,000 acres of existing padi-land, and bring into development an additional 70,000 acres.[3] Even if the target is realized, only half of the total acreage of padi in Malaya would have some form of water control.

Table 30 shows the acreage of padi destroyed during the 1954-55 season. Of the total 28,330 acres that were destroyed, 26,640 acres (94 per cent) were caused by floods or drought. The average yields of padi, as shown in Malayan statistical reports, are arrived at by dividing the total production of padi by the total harvested area. Thus they do not reflect the variations in yields due to individual part causes such as pests, disease, floods, drought, late planting, and so forth. However, as judged by Table 30, the single most important reason for the low yields of the padi crop is lack of water control, and all other methods of increasing crop yields will achieve their maximum effect only if implemented with a full realization of the water requirements of the padi plant.

(3) *Double-cropping.* The policy of increasing padi production by planting two crops a year must be viewed against the background of the water problem.

TABLE 30: PLANTED AREA DESTROYED DURING THE 1954-55 PADI SEASON

STATE	AREA DESTROYED DUE TO FLOODS AND DROUGHT (ACRES)	AREA DESTROYED DUE TO PESTS AND DISEASE (ACRES)	AREA DESTROYED DUE TO MISCELLANEOUS CAUSES (ACRES)	TOTAL AREA DESTROYED (ACRES)
PERLIS	4,500	—	—	4,500
KEDAH	7,120	1,010	—	8,130
KELANTAN	2,350	40	—	2,390
TRENGGANU	2,430	—	50	2,480
PENANG & PROV. WELLESLEY	900	—	130	1,030
PERAK	140	60	—	200
SELANGOR	100	—	—	100
PAHANG	7,320	40	—	7,360
NEGRI SEMBILAN	190	180	180	550
MALACCA	580	180	—	760
JOHORE	830	—	—	830
TOTAL	26,460	1,510	360	28,330

Source: *Monthly Statistical Bulletin of the Federation of Malaya, Rice Supplement, 1955* (Kuala Lumpur, 1955), Table 1A.

1. *Report of the Rice Production Committee, 1953*, pp.1, 75-125.
2. Ibid., p.5.
3. *Federation of Malaya, Report of the D.I.D. for the years 1952, 1953 and 1954* (Kuala Lumpur, 1955), p.33.

In the 1954-55 padi season only 11,200 acres of land (less than 1.5 per cent of the total Malayan padi acreage) were planted with an off-season crop. Of this area 9,330 acres were in Penang and Province Wellesley.[1] Theoretically, a considerable increase in average yield and in total production is possible should a large area of the existing padi land be planted to two padi crops a year. But there are several difficulties that stand in the way of this goal. First and foremost, there must be 'complete water control throughout the year'.[2] But three-fifths of the total padi acreage in Malaya is without drainage and irrigation facilities for even the main crop. The topography of Malaya does not favour the construction of reservoirs, in spite of the heavy rainfall and the large number of streams and rivers, so that 'there remains extensive areas of padi land where adequate irrigation water, particularly for double-cropping, just does not exist.'[3]

Again, to plant two crops a year, the present long-maturation varieties of seed would have to be replaced by varieties of short maturation. There is no evidence that the yields of two short-maturation crops together would be higher than that of a single long-term crop, even if there was complete control of water supply.[4] The padi varieties must be insensitive to different light conditions if double-cropping is to be successfully introduced. In Selangor for instance, where double-cropping has been successfully tried under experimental conditions, the planting dates had to be carefully arranged so that the flowering of the plants did not take place in very dry weather.[5]

To introduce double-cropping on a large scale, it will also be necessary to persuade the peasant to change his working cycle from one in which he enjoyed a long period of leisure to one in which the period of leisure will be greatly reduced. The 1931 Rice Cultivation Committee had earlier drawn attention to the lack of incentive on the part of the Malays to produce more than that required for subsistence.[6] The 1953 Rice Production Committee re-emphasized the fact that the Malays place great importance upon the leisure period, and stated that a very strong incentive would be needed to persuade them to change their habits.[7] As Hill states: 'The whole economy of a Malay rural community is founded on the one annual recurrent rice crop, and to attempt more is to cut at the roots of a very conservative system of society.'[8]

(4) *Off-season Cropping.* A variation of double-cropping is the planting of crops, other than padi, on the land which would otherwise lie fallow after the padi has been harvested. In Kelantan short-term food crops—maize, tapioca, pepper, chilies, beans and sweet potatoes,—are planted in locations close to the peasant's house, and on silt banks and islands below Pasir Mas. The total acreage thus utilized is less than 10 per cent of the total padi acreage in the State.[9] In the Pahang Delta, some dry season crops are also planted on silt islands along the Pahang River.

1. *Monthly Statistical Bulletin of the Federation of Malaya, Rice Supplement, 1955* (Kuala Lumpur, 1955), Table 1c.
2. *Report of the Rice Production Committee, 1953*, p.60.
3. O.J. Voelcker, 'Padi Production in Malaya,' *Report of a Conference of Directors and Senior Officers of Colonial Departments of Agriculture, Wye, Kent, 1953* (London, 1954), pp.90-1.
4. Editorial, *M.A.J.*, Vol. XXIII, No. 6, 1935, pp.260-1; Grist, *Rice*, p.29.
5. F.W. South, 'Rice in Malaya in 1933', *M.A.J.*, Vol. XXI, No. 12, 1933, pp.602-3.
6. *Federated Malay States, Report of the Rice Cultivation Committee, Vol. 1*, p.38.
7. *Report of the Rice Production Committee, 1953*, p.61.
8. A.H. Hill, 'Kelantan Padi Planting', *J.M.B.R.A.S.*, Vol. XXIV, No. 1, 1951, p.63.
9. Dobby, 'The Kelantan Delta', pp.244-5.

The total acreage planted to off-season food-crops in padi land is not known. In the 1954-55 season, 95,616 acres of land were under food-crops other than padi, but 18,100 of these were under vegetables grown mainly on non-padi land by Chinese market-gardeners, and most of the rest of the acreage was under food-crops grown as sole crops on dry land rather than as off-season crops on padi land.[1]

In areas where draught animals are used for ploughing, the fallow season is the only period when there is sufficient fodder (in the form of rice stalks, weeds and grass) to restore their condition for the next season's work.[2] Here off-season cropping is impracticable without disrupting the padi-animal-pasture rhythm.

In other areas, however, it would appear that the cultivation of food-crops on fallow land would be a possible means of increasing peasant crop production, diversifying the agricultural pattern, and providing a much needed variety in the local diet. The Chinese padi-planters in the mukims of Tranquerah and Lorong Pandan in Malacca, for example, cultivate vegetables for the Singapore and Kuala Lumpur markets during the fallow season. The land there has been continuously cropped with padi and vegetables for more than thirty years with no apparent loss of fertility. A short-term padi strain is used so that there is enough time left after the harvest for the vegetable crop. These methods are alien to the Malay planters, and in the 1947-48 season only 25 of the 1,000 acres so cropped were planted by Malays.[3]

In the 1940-41 season an experiment was conducted at the Kota Bharu Experimental Station, Kelantan, to test the possibilities of off-season cropping with vegetables for padi land in Malay areas. The results showed that a 45 per cent increase in the yield of padi could be achieved after the land had been planted with vegetables, so that there was a two-fold gain—in vegetables and in padi yields.[4] Subsequent post-war investigations, however, established that off-season crops would often be impossible unless irrigation water was available during this period.[5] At the same time it must be remembered that both double-cropping of padi, and off-season cropping of non-padi crops, can only be successful after heavy application of manure.[6]

(5) *Manuring of Padi Soils.* Manuring of padi land, whether for the main season padi-crop, for off-season vegetables, or for double-cropping, is influenced by the characteristics of the padi soils and these in turn have an important bearing on yields. A survey of soil conditions in all padi-growing countries shows that, though the crop is grown in practically all types of soil from sandy loams to heavy clays, the heavier soils of river deltas and valleys give better yields than lighter soils. This is found to be true in Malaya, India, Thailand, the

1. Heath, op. cit., App. I, p.82; also *The Economic Development of Malaya,* pp.268-9.
2. T.D. Marsh and V. Dawson, 'The Buffalo in Malaya', *M.A.J.,* Vol. XXXI, No. 2, 1948, pp.103-4; also Dobby, 'The Kelantan Delta', pp.245-8; and *Report of the D.I.D. for the Years 1952, 1953 and 1954,* pp.11-12.
3. J. Cook, 'Fallow Season Cultivation in Padi-Land in Malacca', *M.A.J.,* Vol. XXXI, No. 2, 1948, pp.115-18, and E.H.G. Dobby and Others, 'Padi Landscapes of Malaya', *M.J.T.G.,* Vol. 10, 1957, pp.117-26.
4. Ashby, 'Wet Padi Mechanical Cultivation Experiments in Kelantan, Season 1948-49, p.153.
5. 'Notes on Current Investigation', M.*A.J.,* Vol. XXXIII, No. 3, 1950, p.163.
6. *Federated Malay States, Report of the Rice Cultivation Committee Vol. I,* p.38.

Philippines, Spain and Italy. The ideal soil for padi should contain 50 to 60 per cent of the finer fractions of clay and silt, and should not be entirely impervious.[1]

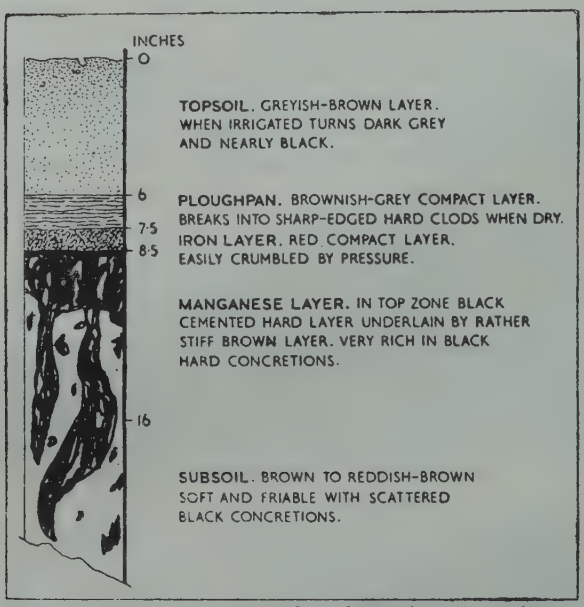

Fig. 24. A Typical Irrigated Padi-Field Soil Profile. Source: F.F.R. Koenigs, 'A "Sawah" Profile near Bogor (Java)', *Transactions of the Fourth International Congress of Soil Science, 1950,* Vol. 1, p.297.

Soils on which wet-padi has been cultivated for a long time tend to develop a hardpan or ploughpan in the lower horizon, which helps to retain the irrigation water. The percolating water causes the leaching of iron and manganese salts, which are deposited in highly insoluble forms in the subsoil, and are eventually compacted into a hardpan consisting of an iron layer above a manganese layer, as illustrated in Fig. 24.[2]

Padi soils are usually classified according to the percentage of clay they contain. In Malaya wet-padi grows best on clay loams (containing 15 to 25 per cent clay), clays (25 to 30 per cent clay), and heavy clays (more than 35 per cent clay).[3] The critical factor is the sand component of the soil. The higher the percentage of sand the less valuable is the soil. Yield variations of padi in Malaya are determined more by the mechanical composition of the soils, and their physical texture, than by their chemical and nutrient content.[4] Table 31 shows the composition and quality of some common padi soils. The first class soils have an organic matter content of 3 to 8 per cent, a clay content of 25 to 65 per cent, a fine silt content of 10 to 25 per cent and a sand content of 2 to 10 per cent. The quality of the land deteriorates where the sand content increases to between 20 and 40 per cent, and becomes second class. Under ideal water conditions first class padi soils can produce up to 2,750 lb. of padi per acre, and second class from 1,375 to 1,925 lb. per acre. Where the sand content is above 40 per cent the soil is very poor and produces very low yields, as exemplified in Soil Sample No. 9 in Table 31. Soil No. 10 has first class qualities but its peaty nature with toxic humic and other acids is detrimental to the young padi plant. There or four inches of peat are sufficient to convert good land into very poor land.[5] Soils with a peat layer composed of organic material derived from the 'gelam' tree (*Melaleuca leucadendron*) occur widely in low-lying swampy riverine and alluvial lands in Malacca, Perlis, Kelantan and Trengganu, and are avoided by the peasants

1. Ramiah, op. cit., pp.8-9. Grist, *Rice,* p.7; also Copeland, op. cit., p.45.
2. de Gens, op. cit., pp.18-19.
3. The best land in Malaya, giving exceptional yields, contains 21 per cent fine silt, 15 per cent silt and 58 per cent clay. Grist, *Rice,* p.16.
4. Jack, op. cit., pp.10-11.
5. Ibid., pp.10-12.

for padi-planting.[1] The padi plant can, however, tolerate a wide range of acidity, extending from pH 4.5 to pH 6.7. The best padi soils in Malaya are in fact the most acid.[2]

TABLE 31: MECHANICAL COMPOSITION AND QUALITY OF REPRESENTATIVE PADI SOILS IN MALAYA

LOCALITY	ORGANIC MATTER PER CENT	CLAY PER CENT	FINE SILT PER CENT	SILT PER CENT	SAND PER CENT	CLASS OF LAND
1. KRIAN	4·0	57·7	20·9	15·3	2·1	FIRST
2. KEDAH	—	28·2	58·1	10·5	3·2	,,
3. KEDAH	—	31·1	31·7	27·2	10·0	,,
4. KUALA KANGSAR	—	26·2	50·4	15·3	7·1	,,
5. JELUBU	4·0	17·5	32·8	16·3	29·4	SECOND
6. KUALA PILAH	—	17·6	28·1	16·6	37·7	,,
7. KUALA KANGSAR	—	18·6	27·4	14·0	40·0	,,
8. JELUBU	1·6	19·1	30·2	7·3	41·8	,,
9. KUALA KANGSAR	—	6·9	10·2	14·0	68·9	THIRD
10. KRIAN	12·8	28·9	34·6	15·6	8·1	,,

Source: Jack, op. cit., Table V, p. 10.

In those areas in the Asian tropics where yields are higher than the average, some form of fertilising with organic manures, especially green manures, is common.[3] In Burma, for example, the usual practice before planting is to turn down the weeds which have sprung up since the beginning of the rainy season. This gives a yield increase of 5 per cent. However, in Thailand yields would have to increase from 30 to 100 per cent in order to make the application of fertilisers an economic proposition.[4]

In Malaya regular manuring is practised in Kedah, and, to a lesser extent, in Province Wellesley, where heavy dressings of bat guano are applied. The average rate of dressing is equivalent to 50 lb. of phosphorus per acre per annum, and the resultant yield increase is about 186 lb. per acre.[5] In Kelantan and Malacca the peasants dip the padi seedlings into a mixture of cow manure and wood ash before transplanting. In other areas the land is cultivated year after year without any application of manure.[6]

The results of manurial trials in Malaya have not been encouraging. Ploughing-in of padi straw has failed to give any significant increase in yields.[7] Although guano, cow-dung and bone-meal are used by peasants in Kedah, Perlis, Kelantan and Malacca, experiments conducted by the Department of Agriculture over a ten year period showed that those peasants in other areas who did not

1. J.K. Coulter, 'Gelam Soils', *M.A.J.*, Vol. XXXV, No. 1, 1952, pp.22, 32-3.
2. Ramiah, op. cit., p.9; and Grist, *Rice*, p.9.
3. Grist, *Rice*, pp.202-3.
4. F.A.O., *Report of the Second Meeting of the Working Party on Fertilisers* (Rome, 1953), pp.33-4, 37-8.
5. E.F. Allen, 'Padi Manurial Trials in the 1950-51 Season', *M.A.J.*, Vol. XXXV, No. 3, 1952, pp.137, 140.
6. Buckley, op. cit., p.120.
7. F.A.O., *Report of the Third Meeting of the Working Party on Fertilisers* (Rome, 1953), p.120.

apply these manures suffered no disadvantages in crop yields.[1] The most significant conclusions of these trials are, firstly, that there is a 'bar' which limits the maximum yields of padi throughout the Peninsula. The upper limit of yields is from 2,200 to 3,025 lb. per acre depending upon local conditions.[2] Secondly, manuring can increase yields only in those areas where the normal yield is considerably below the maximum. Along the west coast where yields are high, by Malayan standards, applications of manure were not worth while. Along the east coast, however, where padi yields are generally very low, good responses to fertilisers have been obtained.[3] During the 1951-52 season 316 manurial trials were held on padi land in Kelantan and Trengganu, and the results indicated that an application of 200 lb. of a balanced standard mixture of fertiliser gave a yield increase of 440 to 550 lb. per acre. The cost of the fertiliser was equivalent to the value of 275 lb. of padi, so that there was a net gain of between 165 and 275 lb.[4] Altogether about 200,000 acres of light soils along the east coast have been found to be deficient in soluble phosphates and nitrogen, and these are the only soils in Malaya that would benefit from the application of fertilisers.[5]

Similar experiments with the deep ploughing and manuring of dry-padi land in Kelantan and Trengganu proved that yields of 1,210 to 1,375 lb. per acre could be obtained in such soils which normally yielded 715 lb. per acre.[6] Since the main dry-padi areas in Malaya are in these two States (39,000 acres out of the total Malayan acreage of 47,000 in 1954-55), there is a definite possibility here of increasing crop production through the use of manure.

The problem for the Malayan Government is how to popularise the application of fertilisers among peasants who have never known their use. In 1952 a fertiliser campaign was started in Kelantan. Half the cost of the fertilisers purchased by the peasants was subsidised by the Government, while the Rural and Industrial Development Authority provided free transport. The minimum dressing was 200 lb. per acre, and the peasant had to pay $48 to manure three acres of land.[7] Although yield increases of between 30 and 400 per cent were recorded by those peasants who applied fertilisers,[8] only 210 tons of fertilisers were bought during the 1952-53 season, whereas the requirements were estimated at 40,000 tons.[9] Some 720 tons were bought in 1953, and 296 tons in 1954. The reasons given for the poor response were, shortage of ready cash, the reduction in the subisdy rate, and the conservative attitude of the peasants regarding the use of fertilisers.[10]

1. F. Birkinshaw, 'A Review of Field Experiments on Padi in Malaya', *M.A.J.*, Vol. XXVIII, No. 12, 1940, p.509.
2. Belgrave, 'Padi Manurial Experiments, 1933-34', p.583.
3. R.G.H. Wilshaw, 'Padi Manurial and Minor Cultural Trials, Seasons 1937-38 and 1938-39', *M.A.J.*, Vol. XXVII, No. 12, 1939, pp.528-9. Also E.F. Allen, 'Padi Manurial and Cultural Trials in the 1949-50 Season', *M.A.J.*, Vol. XXXIV, No. 1, 1951, pp.25-6; and 'Padi Manurial Trials in the 1950-51 Season', pp.153-4.
4. 'Notes on Extension Work, April to June 1952', *M.A.J.*, Vol. XXXV, No. 3, 1952, p.177.
5. F.A.O., *Report of the Second Meeting of the Working Party on Fertilisers*, 1952, p.38.
6. E.J.G. Berwick, 'Dry Padi Mechanical Cultivation Experiments, Kelantan, Season 1950', *M.A.J.*, Vol. XXXIV, No. 4, 1951, pp.204-5; and *Annual Report of the Department of Agriculture, 1950 and 1951* (Kuala Lumpur, 1953), p.45.
7. *Report of the Rice Production Committee, 1953*, p.28.
8. 'Notes on Extension Work, January to March 1953', *M.A.J.*, Vol. XXXVI, No. 2, 1953, pp.128-9.
9. Voelcker, op. cit., p.91; F.A.O., *Report of the Second Meeting of the Working Party on Fertilisers*, p.38.
10. *Annual Report of the Department of Agriculture, 1954*, p.69.

(6) *Padi Varieties.* There is much room for increasing yields in the tropics through the planting of improved varieties of seed. In the Philippines a 20 to 40 per cent increase has been estimated as possible by this means, in India the increase was estimated at 10 to 30 per cent,[1] in Thailand 15 per cent[2] and in Malaya 10 to 20 per cent.[3] The problem of selecting improved seed varieties is a very complicated one because each strain selected has to be suited to a particular set of environmental conditions. In Malaya, for example, the majority of padi varieties are long-maturing, because of the lack of water control and because agricultural conditions preclude the growing of short-term varieties.[4] According to Grist, the best line of approach in selecting new strains for tropical areas would be to produce hybrid varieties of the *indica* and *japonica* groups.[5]

There are between 300 and 400 distinct padi varieties in use in Malaya. The most important of these are the 'Seraup' and 'Radin' types, which are probably planted on about 80 per cent of the total padi area in the Peninsula. The 'Seraup' type is confined to the best soils of the north-west, and is one of the highest yielding varieties, giving an average of 2,750 lb. per acre, but it occupies only about 25 per cent of the total Malayan area.[1] The 'Radin' type is the most popular in the country, occupying more than half the total Malayan acreage. It is grown mainly for subsistence in both large and small padi areas.[6] Post-war varietal trials have shown that the long-maturation types (between 200 and 220 days maturation period) are higher yielding than the medium and short-term varieties (between 140 and 180 days maturation period). But these yield differences are found to be due to the fact that the long-maturation types are grown on the better soils, and are not due to the quality of the seed.[7]

The majority of varieties are of restricted adaptability, and do not grow well outside the ecological environment and latitudinal range to which they are best suited. The aim of the Department of Agriculture is to select, through experimentation, breeding and cross-breeding, those types giving the highest possible yield per acre under the different local growing conditions. After the best varieties have been determined experimentally, a 'diffused' or 'extension' variety trial is held to determine their optimum distribution in each locality, before the selected seeds are distributed to farmers.

Pre-war experiments established that with a good water supply, and very heavy clay soils, the long-term strains ('Seraup' Nos. 1, 15, 36, 48, and 371) gave the highest yields. On loams and lighter soils the best varieties were the medium-maturation types—'Radin', 'Nachin' and 'Siam'.[8] The war saw the destruction of pre-war work on seed selection, and a fresh start had to be made in 1947. Since it normally takes ten years from the commencement of selection experiments to the time when seed can be distributed on a large scale to farmers, the new varieties tested in 1947 would not be available until 1957. However, work was accelerated so that the seeds of two new varieties ('Serendah Kuning' and 'Nachin') could be distributed by 1954 or 1955.

1. Ramiah, op. cit., p.19.
2. Grist, *Rice,* p.271.
3. Voelcker, op. cit., p.92.
4. Ramiah, op. cit., p.20.
5. D.H. Grist, 'The Rice Problem', *M.J.T.G.,* Vol. V, 1955, pp.21-2.
6. Jack, op. cit., pp.52-3.
7. L.N.H. Larter, *Rice Variety Trials in Malaya, 1947-50* (Singapore, 1953), pp.5-6 and App.3, pp.87-8.
8. H.W. Jack, 'Padi Experiments in Malaya, 1932-33', *M.A.J.,* Vol. XXI, No. 12, 1933, p.605.

The first of the post-war varieties, 'Nachin 57', was ready for distribution in 1955. It is capable of giving a yield of about 300 lb. per acre more than the unselected varieties and is easy to grow, thresh and mill. The Department of Agriculture hopes that the 17,000 acres of coastal padi land in Malacca will, in time, be planted to this new strain, and states that if the planters 'can be persuaded to grow 'Nachin 57' it will increase padi production in Malacca by about 1.5 million gantangs'.[1] It is not easy to persuade the Malays, who have built up elaborate traditions and prejudices regarding padi cultivation, to adopt the new pedigree strains of seed. High yields alone are not sufficient, the grain must have suitable cooking and milling qualities as well as eating flavour. It may happen, therefore, that the demand for the seed of certain high yielding varieties falls far below expectation.[2] The Rice Production Committee found that though the cost of new seed was subsidised, or even waived altogether, the farmers have not come forward in the numbers expected, and the results have not been encouraging, except in Kedah and some other parts.[3]

(7) *Pests and Disease.* All varieties of padi are subject to the attacks of disease and the depredations of pests at every stage of their growth. To reduce the losses from these attacks would mean a net increase in production.[4] Several tens of thousands of hectares of lowland padi are destroyed, or seriously damaged, each year in Indonesia by a disease known as 'mentek'.[5] In Malaya a preliminary survey of a hundred nurseries in the main padi areas of Kedah, Perak, Province Wellesley, Negri Sembilan, and Malacca showed that 25 per cent of them were severely affected by leaf-spotting organisms (mainly *Helminthosporium oryzae, Nigrospora spp., Piricularia oryzae* and *Curvularia spp.*), 55 per cent were lightly infected with various leaf spots, 2 per cent heavily infected by a disease of the stem and leaf-sheath and only 18 per cent were free from any serious disease.[6]

Birds, monkeys, elephants and other pests are responsible for substantial crop losses each year. Control measures must be exercised continuously to be effective, especially when the plant has tillered and the grain is ripening. The pest responsible for widespread grain losses is the rat. Over a six year period from 1926 to 1931, 5.5 million rats were killed in Krian alone. The annual saving of padi was estimated as sufficient to feed 12,000 people each year.[7] Over 100,000 rats are destroyed each year in Kedah.[8] Rats, and the damp weather, result in an estimated 10 per cent loss of padi kept under local storage conditions.[9] Insect pests, of which there are some seventy-four species in Malaya, attack both the plant and the ears.[10] Experiments have shown that the difference in yields between

1. 2,500 tons, *Straits Times*, 12th June 1955.
2. *Federated Malay States, Report of the Rice Cultivation Committee, Vol. II*, p.59.
3. *Report of the Rice Production Committee, 1953*, pp.32-3.
4. The world production of rice would be increased from 5 to 10 per cent if field and store pests alone were controlled. See Grist. 'The Rice Problem', p.22.
5. G.A.W. van de Goor, 'The Mentek Disease of Lowland Rice in Indonesia', *Netherlands Journal of Agricultural Science*, Vol. II, 1954, p.44.
6. 'Notes on Current Investigations, July-September 1953', *M.A.J.*, Vol. XXXVI, No. 4, 1953, p.250.
7. Editorial, *M.A.J.*, Vol. XIX, No. 3, 1931, p.111. Also F.W. South, 'Rat Destruction in Malaya', ibid., pp.112-22.
8. *Report of the Rice Production Committee, 1953*, p.81. Also *Straits Times*, 2nd December, 1954.
9. *Report of the Rice Production Committee, 1953*, pp.66-7.
10. N.C.E. Miller and H.T. Pagden, 'Insect Pests of Padi in Malaya', *M.A.J.*, Vol. XVIII, No. 6, 1930, pp.289-92.

a padi crop attacked by borers, and one protected against them may be as high as 130 gantangs (715 lb.) per acre.[1] The new insecticides may prove effective against certain pests, but their application in the smaller, scattered padi lands depends upon the cost factor. A good system of water control, and the adoption of proved cultural techniques, are considered the best methods of reducing crop losses due to pests.

(8) *Farming Practices.* Padi yields can often be improved by modifications in farming practices. Padi-planting techniques in Malaya have been developed over a long period of time, and in seeking to increase crop production, either by methods of cultivation or through modifications of existing methods, there is always the difficulty that the new techniques may not be suited to a particular local environment. Also, even if they are suitable, inertia, tradition and custom may form a barrier resistant to all efforts at change.

Variations in customary methods of padi cultivation in the Peninsula are due chiefly to local differences in the soils, distribution of rainfall, water supply and topography, but the basic pattern remains the same. In most cases the seeds are sown in small prepared nurseries, and the seedlings are later transferred to the flooded fields. After-cultivation consists of frequent weeding operations, and of regulating the water supply. The land is drained before the crop ripens. After the harvest it lies fallow until the next planting.[2] The methods of preparing the land for transplanting depends on the nature of the soil, and the economic position of the farmer. Ploughing and harrowing with buffaloes is the usual practice in Kedah, Perlis, Kelantan and Malacca. Farmers in other parts of the country do not plough the fields, but cut down the fallow growth just below the soil surface with a scythe called the 'tajek'. The vegetation is then allowed to rot for some time under water. This method is common in those areas (Krian and Pahang) where the very deep and soft muddy soil prevents the use of the plough, because the buffaloes would founder in the mud.

Malay planting methods have been tested experimentally and proved sound, and attempts to improve on them have failed. The practice of incorporating green manure as late as possible before transplanting has been established as scientifically correct.[3] The custom of transplanting the seedling two or three times, as in the Krian area, is also a good one. A number of experiments by the Department of Agriculture showed that frequent transplanting acted in a similar way to root-pruning, by stimulating the growth of the sub-aerial plant section and increasing the number of tillers, and thus the yield. When a single transplanting was tried the yield was poor.[4] The shallow ploughing (down to a depth of 4 in.), usual in Kelantan, was thought to be deleterious to padi yields, and so deep cultivation (down to a depth of 12 in.) was tried in an experimental attempt to increase yields. The results of three years' work showed, however, that yields could not be significantly increased by deep ploughing.[5] The Department of Agriculture has concluded that 'Malay methods of cultivation cannot be lightly brushed aside in favour of modern methods; rather the investigator must introduce innovations with the utmost caution and only after exhaustive trials at local experimental stations.[6]

1. G.H. Corbett and H.T. Pagden, 'A Review of Some Recent Entomological Investigations and Observations', *M.A.J.*, Vol. XXIX, No. 9, 1941, p.350.
2. 'Padi Planting Methods in Malaya', *M.A.J.*, Vol. XXVII, No. 2, 1939, pp.42-59.
3. 'Manurial Experiments with Rice', *M.A.J.*, Vol. XVIII, No. 1, 1930, pp.56-7.
4. Jack, *Rice in Malaya*, p.58.
5. Ashby, 'Wet Padi Mechanical Cultivation Experiments in Kelantan, Season 1948-49', p.153.
6. Editorial, *M.A.J.*, Vol. XXVII, No. 2, 1939, p.39.

However, there is one barrier to optimum yields. It arises from discordances between the physiological requirements of the padi plant (in relation to the rainfall cycle), and the annual planting cycle followed by the peasants, based on the Muslim lunar calendar. Every stage in padi cultivation is marked by a religious ceremony. Most of these aim at placating the 'semangat padi', the soul of the padi plant.[1] Before Islam came to Malaya, about six centuries ago, dating was based on the solar year, and the planting ceremonies were also geared to it. But when the Muslim calendar was superimposed on the solar calendar, there was confusion in the planting cycle. The Muslim calendar is unconnected with seasonal events, and is eleven days short of the solar year and gives no guidance in fixing the agricultural year. The peasants therefore had to recourse to the old form of dating by the solar year.[2] Islam also brought its own religious observances which had no connection with the planting rhythm. Of immediate consequence to agriculture in general, and padi-planting in particular, is the Muslim custom of observing the Ramadan fast, which lasts one month each year. It falls on the ninth month of the lunar calendar. During the fast no food or drink may be consumed during the hours of daylight. When Ramadan falls on a month when hard physical labour is required, that is between March and August when the fields are being prepared for transplanting of seedlings, the working efficiency of the peasants is seriously reduced. For example, from 1947 to 1949 ploughing was retarded in many parts of the Peninsula because the fasting months were from May to July.[3]

Because of the risks normal to farming everywhere the padi-planter in earlier days tried to grow as many varieties of the seed as possible, each of a different maturation length. The nurseries were sown with 'padi tua' (old padi), 'padi penengah' (medium-term padi) and 'padi muda' (young padi), with an interval of about one month between each sowing. The transplanting period was consequently extended; the variety with the longer maturation length being transplanted earlier, and the others spaced out accordingly, so that all would ripen simultaneously. This was done in order to spread the risks arising from rainfall fluctuations. The practice still prevails in many parts of the Peninsula. But while it acts as a guarantee against total crop failure, it does not make for high yields, as the crop often does not ripen evenly at the same time, but in patches, and is more liable to suffer from the attack of birds and rats. Because of this, and because the majority of the main padi varieties are photo-sensitive, the State Governments have passed laws requiring the peasants to complete their planting by a certain date (which varies according to each locality), so as to achieve the required uniformity of ripening and harvesting. On the east coast, sowing must be timed so that the harvest can be gathered in before the Monsoon floods. In the Pahang Delta extensive areas of padi are destroyed periodically, because the padi is planted so late that the grain fails to ripen before the annual floods arrive. In Kelantan the land is baked hard by the hot dry weather between March and July, and the ground cannot be ploughed if the showery weather of June fails to develop. The padi has then to be planted later, and in most cases yields are reduced. Legislation compelling the peasants to sow and plough by a definite date is unavailing if the peasants are not also ensured of a regular water supply. The ineffectiveness of such legislative measures is attested by the constant reference, in the official reports, to crop failures due to 'late planting'.

1. R.O. Winstedt, *The Malay Magician* (London, 1951), pp.39-55.
2. Hill, op. cit., pp.59-61.
3. Lim Joo-Jock, 'Tradition and Peasant Agriculture in Malaya', *M.J.T.G.*, Vol. 3, 1954, pp.44-7.

(9) *Mechanical Cultivation of Padi Land.* The possibilities of introducing mechanical methods of cultivation to speed up the rate of work, and to take advantage of favourable weather conditions and so prevent late planting, are being tested in Malaya. Production may be increased if the work of cultivation is accelerated by mechanization, so that a sufficiently long off-season remains for double-cropping, or if mechanization enables the farmer to work a larger acreage of land. The possibility of increasing yields by deeper ploughing with tractors has also been tried experimentally.

One of the main technical problems in Malaya is the mechanical cultivation of wet land. In Australia and the United States of America the mechanical cultivation of padi is possible because there is efficient water control at all stages, and the land is usually drained dry before ploughing begins. In Malaya, however, as in most South-east Asian countries, such drainage schemes as exist are rarely capable of removing the large quantities of rain-water that may fall at any time and within a short period.[1] Ploughing in the dry, before the fields are flooded, is often impossible. On land with a firm foundation or hardpan, successful cultivation with tractor-drawn ploughs has been achieved in Province Wellesley and Kelantan.[2] In peaty and other lands with very soft soils, however, the tractors easily bog down. Tractor ploughing on such lands depends upon the use of low-pressure-bearing tractors, and on considerable luck with the Malayan rainfall. Progress in peaty land is also often impossible because of the presence of sunken tree stumps. Most of the potential padi-lands in Malaya have peaty and bog soils, and so far the mechanical cultivation of such soils has not been satisfactory.[3]

The mechanization of seeding and transplanting operations has not been investigated. Weeding, which normally needs the greatest expenditure of time and labour, has not been successfully accomplished by machines.[4]

Fast mechanical harvesting would seem to offer great scope for indirectly increasing production by lessening the chances of an untimely rainstorm spoiling part of the crop.[5] The Malay method of harvesting is to use a small knife (called 'rengam' or 'tuai') and to cut one head of padi at a time. This is slow and laborious work, but it is hallowed by tradition and superstition. There are several advantages of 'tuai' harvesting. The unevenly ripened grains, or grains of mixed varieties, can be harvested separately. A minimum amount of equipment is used, and only the crop weight is handled and not the stalks. The main disadvantage is that the slowness of this method tends to increase the likelihood of crop damage through adverse weather. However, mechanical harvesting experiments have not been encouraging. The results showed that the work performed by machines was not much quicker than that done by traditional methods. Extra labour was also needed to separate the ears from the stalks.[6] Successful experiments have been

1. C.W.S. Hartley, 'Investigations into the Mechanical Cultivation of Wet Padi, 1948-49: a General Review', *M.A.J.*, Vol. XXXII, No. 3, 1949, p.141.
2. H.K. Ashby, *Wet Padi Investigations in Kelantan, Season 1949-50* (Kuala Lumpur, 1951), p.78; and P.G. Coleman, 'Investigations into Mechanical Cultivation of Wet Padi in Province Wellesley during the Season 1948-49', *M.A.J.*, Vol. XXXII, No. 3, 1949, pp.177-8.
3. E.F. Allen and D.W.M. Haynes, 'A Review of Investigations into the Mechanical Cultivation and Harvesting of Wet Padi with Special Reference to the Latter', *M.A.J.*, Vol. XXXV, No. 2, 1953, p.62.
4. Ibid., pp.64-5.
5. Because of the rituals and ceremonies observed by the Malays before they start harvesting, the whole crop may be left standing for as long as seven days after it has ripened, with consequent risks of loss due to pests and inclement weather.
6. Ashby, 'Wet Padi Mechanical Cultivation Experiments in Kelantan, Season 1948-49', pp.165-6.

made with a combine-harvester, which could reap half to three-quarters of an acre of padi per hour.[1] But poor drainage is thought to militate against the success of this harvester in Malaya.[2] As Grist states, 'Any attempt to mechanize padi cultivation without first being assured of complete water control at all times is doomed to failure'.[3]

The question of costs is the critical and decisive factor in the introduction of mechanical cultivation of padi. Costs are determined by the types of machines used, the availability of spare parts and workshop facilities, the running expenses, the length of time each machine would be employed in a season and the length of time it is idle during the off-season. In Kelantan, it was found that all the machines were expensive to run and required a disproportionate amount of labour to operate. Working the whole day in mud was too exhausting for a single operator, and a team of extra men was necessary if the machines were to be used to their maximum capacities.[4] Because of the wet ground, running costs per acre were high. In Pahang, experiments demonstrated that when the surface was dry a tractor could plough eight acres of land in a working day of eight hours. A wet surface reduced performance to as low as four acres a day, though the fuel consumption was not reduced. The running costs per acre per day, under dry conditions, were $3.06, while under wet conditions the costs were exactly doubled.[5] When translated from experimental to field conditions, the total cost of tractor cultivation was $7.50 an hour. This was the charge made by the Rural and Industrial Development Authority for the hire of its tractors. It covered only the running costs, depreciation and interest on capital, but did not include any profits. The peasant planter must, on such a basis, expend $20 in cash to cultivate his holding of about three acres. This is a sum of money usually beyond his means to spend.[6]

Again, the fact that equipment and machines may either have to stand idle for long periods during the off-season, or be transported over long distances to areas with a different planting season, would tend to increase the overall costs.

Mechanization of existing padi-lands demands the consolidation of small fragmented fields, so that the enlarged size would make tractor working more efficient. In the usual Malay padi landscape the overall pattern is a checkered one, composed of tiny rectangular or square fields, each separated from the other by a raised bund. The Malay laws of inheritance tend to reduce the size of the fields through repeated sub-division. Mechanization would involve upsetting this system of land tenure, and would probably encounter considerable resistance if introduced too rapidly. Mechanization in other parts of South-east Asia has led to the shifting of tenant labour to hired labour, and to other dislocations of the tenant group of farmers.[7] In a similar manner, agricultural mechanization in Africa has tended to sharpen the conflict between young and old, to weaken established forms of discipline and to produce widespread social changes, and

1. *Malayan Bulletin,* Vol. VIII, No. 87, 1954, para. 146.
2. P.G. Coleman, 'Wet Padi Mechanization Investigations in Province Wellesley during the 1950-51 Season', *M.A.J.,* Vol. XXXVI, No. 1, 1953, p.19.
3. Grist, 'The Rice Problem', p.23.
4. Ashby, 'Wet Padi Mechanical Cultivation Experiments in Kelantan, Season 1948-49', pp.162-4.
5. J.R. Curry, 'Investigations into the Mechanical Cultivation of Wet Padi on Coastal Clays in the South of Pahang', *M.A.J.,* Vol. XXXI, No. 1, 1948, p.38; also Hartley, op. cit., pp.145-7.
6. *Report of the Rice Production Committee, 1953,* p.30.
7. E.H. Jacoby, *Agrarian Unrest in S.E. Asia* (New York, 1949), pp.19-20.

'unless these changes are acceptable to the Africans, the disadvantages may outweigh the gains.'[1]

The main reason for the initiation of investigations into the possibility of mechanical cultivation in Malaya in 1948 was the high cost of agricultural labour, and the fear of a labour shortage in future years.[2] Because of the rapid rate of population growth, however, the expected shortage did not develop, and by 1954 the International Bank Mission was able to report that, 'While considerable attention has been given to the possibilities for mechanising padi cultivation, it is recognised that, with an adequate and increasing labour force and limited alternative employment possibilities, the justification for mechanization must rest on grounds other than the saving of labour'.[3]

For these reasons, mechanization in lands already occupied by peasant farmers is not likely to supersede the traditional use of human and animal labour. Mechanization has also been advocated as a means of opening up the undeveloped swamps of South-east Asia, especially the very extensive areas in eastern Sumatra and Borneo. The total area of low swampy land available for padi development in Malaya has not yet been accurately surveyed. In 1931 the Rice Cultivation Committee estimated the total potential padi-land as being between 600,000 and 1,000,000 acres.[4] This is now known to be an over-estimation. Post-war surveys established that 313,000 acres of swamp jungle could be developed for padi, with a further 450,000 acres remaining as possible areas.[5] The main areas are, however, located to the south of latitude 4°30'N. (Fig. 25), where, as noted earlier, climatic conditions are less favourable for padi cultivation. The latest information available indicates that over half of the total 763,000 acres is peat-covered and unsuitable for padi.[6] The most promising locations for large scale mechanization in Malaya are the large continuous plains

Fig. 25. Potential Padi Areas in Malaya, 1953. Based on Allen and Haynes, op.cit., p.62.

1. *The Observer,* 1st October, 1950.
2. A.E.S. McIntosh, 'The Standing Committee on Crop Investigations with Special Reference to Investigations into Mechanization'. *M.A.J.,* Vol. XXXI, No. 1, 1948, pp.5-6.
3. *The Economic Development of Malaya,* p.255.
4. *Report of the Rice Cultivation Committee, Vol. 1,* p.20.
5. *Draft Development Plan of the Federation of Malaya* (Kuala Lumpur, 1950) p.39.
6. *The Economic Development of Malaya,* p.296; *Federation of Malaya, Annual Report of the D.I.D., 1949* (Kuala Lumpur, 1950), p.29.

in the lowlands, such as the Bruas-Sitiawan plain where 180,000 acres of swamp are being drained and irrigated for padi.[1] But mechanical cultivation is likely to prove expensive in view of the fact that these swamps contain rotting tree stumps and submerged timber which have to be removed before cultivation can begin.[2]

PIONEER SETTLEMENT IN PADI AREAS.

Although padi is the only cereal capable of giving sustained yields over a long period of time without exhausting the fertility of tropical soils, its cultivation in Malaya is a risky occupation because of the lack of water control, the unfavourable climate, and the depredations of pests and disease. Crop failures are liable to occur at any season, with consequent hardship to the farmers.

The process of pioneering for padi is an arduous one, involving the clearing and draining of swamps, the construction of irrigation works and often the preliminary burning off of the peat layer. All this has to be done under waterlogged conditions, and in mosquito and disease infested country. The labour of preparing the land for planting, especially where there are no draught animals, and of transplanting and weeding by hand, all demand considerable physical effort in the hot and humid atmosphere of the padi environment.

At the same time the low economic returns from padi cultivation compare unfavourably with the returns from almost every other agricultural occupation in Malaya, and in particular with rubber growing. The smallholder could obtain more rice by purchasing it with the proceeds from an acre of rubber than by growing it directly from the same area of land. Even when slump prices prevail, rubber is still more profitable to grow than padi, as illustrated in Table 32. At the height of the Great Depression in 1932, when the price of rubber was only 6 cents per lb., the rubber smallholder received the equivalent of 48 lb. of cleaned rice more than the padi-planter. In times of higher rubber prices, rubber as an occupation was vastly more remunerative.

Padi-planting has never been a popular occupation with the Chinese. Jordan attributed this disinterest amongst the Chinese to low yields and small profit

TABLE 32: COMPARISON BETWEEN RUBBER AND PADI CULTIVATION AS A MEANS OF SECURING A GIVEN QUANTITY OF RICE

YEAR	POUNDS OF HUSKED PADI OBTAINABLE WITH PROCEEDS FROM ONE ACRE OF RUBBER	POUNDS OF HUSKED PADI OBTAINABLE WHEN GROWN DIRECT FROM ONE ACRE OF LAND	BALANCE IN FAVOUR OF RUBBER (IN LB. OF PADI)
1929	2184	424	1760
1930	1200	344	856
1931	912	568	344
1932	688	640	48
1933	1248	608	640

Source: Bauer, op. cit., Table 1, p. 61.

1. Work on swamp reclamation started in 1953; *Malayan Bulletin*, Vol. VII, No. 75, 1953, para. 114.
2. E.F. Allen and E.W. Bewlay, 'Investigations into the Mechanical Cultivation of Wet Padi on Peat Soils in the South of Perak', *M.A.J.*, Vol. XXXI, No. 1, 1948, pp.37-43; also D.W.M. Haynes, 'The Mechanical Cultivation of Wet Padi Land in the Federation of Malaya', *Federation of Malaya, Final Report of the Rice Committee*, (Kuala Lumpur, 1956), App. VII, pp.120-8.

margins. Two attempts to settle Chinese on padi land were failures because the settlers preferred to grow rubber.[1] In 1947 only 45,000 Chinese were padi cultivators, compared with 471,000 Malays.[2]

Today padi, even among the Malays, is no longer being planted as a matter of course. This is because of the heavy work involved, 'the higher earnings to be received from alternative occupations, the attractions and amenities of town life as compared with the hard conditions in the villages'.[3] A statistical indication of this disinterest in padi is given in Table 27, which shows that there was a sharp decline in the total padi-planted acreage between 1948 and 1952, and a gradual, but not complete, recovery between 1952 and 1954. The greatest decrease in acreage (65,000 acres) was between the 1950-51 and 1951-52 seasons. Apart from the unfavourable weather, the other main reason for this decline was the siphoning of labour to other occupations.[4] The Rice Production Committee, which was appointed to look into the matter, suggested that, among the other reasons already discussed, the decline in acreage was due to the high price of rubber, copra and other cash-crops, the attraction of high earnings from mining and the lack of amenities in the rural areas.[5]

The reclamation of an undeveloped swamp area is only the preliminary step in the colonization of that area. The padi settlement schemes in Malaya (Table 33 and Fig. 1) have, from the start, been only moderately successful because of a marked lack of response on the part of the people to take up the new land for padi cultivation. Apart from the fact that pressure of population on land in the Peninsula is confined to only a few localized regions, there are several other reasons for this reluctance to settle in the new lands. Pioneer settlement in the tropics is always an arduous and difficult process, and the pioneer settler in Malaya

TABLE 33: MAJOR PADI SETTLEMENT SCHEMES IN MALAYA, 1954

NAME AND LOCATION OF SCHEME	AREA PLANTED PRIOR TO SCHEME (ACRES)	ADDITIONAL AREA MADE AVAILABLE AS A RESULT OF SCHEME (ACRES)	TOTAL PADI AREA (ACRES)
SOUTH PERLIS, PERLIS	14,900	4,000	18,900
KUBANG PASU, KEDAH	65,000	10,000	75,000
KRIAN, PERAK	29,259	28,669	57,928
SUNGEI MANIK, PERAK	1,249	17,169	18,418
CHANGKAT JONG, PERAK	—	2,434	2,434
TANJONG KARANG, SELANGOR	198	48,763	48,961
BESUT, TRENGGANU	21,600	5,000	26,600
PAYA BESAR, PAHANG	—	2,917	2,917
PAHANG TUA, PAHANG	686	2,776	3,462
TOTAL	132,892	121,728	254,620

Source: Federation of Malaya, *Report of the D.I.D. for the years 1952, 1953 and 1954*, App. 'F', pp. 113-24.

1. *Report of the Rice Cultivation Committee, Vol. II*, App. 3, pp.176-80.
2. del Tufo, op. cit., Table 78, p.442.
3. *Report of the Rice Production Committee, 1953*, p.4.
4. *Malayan Bulletin*, Vol. VI, No. 71, 1952, para. 460; *Straits Times*, 17th October, 1952; and *Annual Report of the Department of Agriculture, 1952* (Kuala Lumpur, 1953), p.6.
5. *Report of the Rice Production Committee, 1953*, p.11.

has to face several years of hard work with poor returns before his fields can begin to produce a reasonable income. It takes a minimum of three years before the settler can start to plant padi. He has first to clear the land, build his house, and construct his 'sawahs' (wet-fields), and during this time he has to find work elsewhere to support his family.[1] The land is granted on a short-term basis (usually on a Temporary Occupation Licence or T.O.L.), because of the Government's reluctance to issue permanent titles until detailed geological surveys have been made in order to determine whether the land is tin-bearing. This form of tenure also acts as a deterrent to settlement.

The area of land issued to each settler varies from region to region. In Sungei Manik, experience has shown that a Malay family could gain a fair livelihood by cultivating six acres of padi and planting kampong produce (fruit and vegetables) in another two acres of higher, non-irrigated land.[2] On many of the other schemes, however, the settler is given only two acres of padi-land, an area too small to produce any appreciable surplus above his subsistence needs. In Tanjong Karang, the three acres of padi land and one acre of kampong land allotted to a settler are now regarded as being inadequate for a good livelihood.[3] In the Sungei Manik area, the kampong belt on which the peasants build their houses, plant their fruit trees and have their vegetable plots, is situated at a considerable walking distance from the padi-fields.[4] This instance of defective planning has been noted by the Rice Production Committee, which has recommended that no kampong land be allocated which would entail the farmer walking more than two miles from house to field.[5]

Many of the schemes, including the large ones like Sungei Manik and Tanjong Karang, provide only the most rudimentary facilities for the settlers. Colonists who took up land in the Kuala Selangor Colonization Area before the war were promised a subsidy of $12 per acre, facilities for the education of their children, as well as a clean water supply and fair roads. Up to 1949, however, nothing had been done to fulfil these promises.[6] The lack of amenities in the Tanjong Karang Area was noted as early as 1946.[7] In 1953, the Rice Production Committee found the shortage of amenities in this important settlement area 'remarkable'. There were only three schools to serve a population of between 50,000 and 60,000 people. The area had no government hospital and there was a shortage of nurses. Also the water supplies were inadequate. Poor transport facilities put the peasants in the very unfavourable position of having to sell their produce to private buyers, at prices much lower than the current market rates.[8]

The shortage of food in Malaya in recent years led the Government to promise more liberal terms in order to encourage settlement. These included free transport to the colonization area, temporary housing, a $33 to $50 subsidy for each acre of land cultivated, loan of saws, axes, 'parangs' (long-handled knives) and 'changkols' (Chinese hoes), free seed for the first two years and a guaranteed

1. *Federation of Malaya, Annual Report of the D.I.D., 1949,* p.26.
2. D.S. Ferguson, 'The Sungei Manik Irrigation Scheme', *M.J.T.G.,* Vol. 2, 1954, p.14.
3. *Federation of Malaya, Annual Report of the D.I.D., 1948,* p.34. Also McNee, op. cit., pp.12-14.
4. Ferguson, 'The Sungei Manik Irrigation Scheme', Fig. 1, p.11.
5. *Report of the Rice Production Committee, 1953,* p.104.
6. *Proceedings of the Fed. Leg. Co., March 1949-January 1950* (Kedah, 1952), p.32.
7. *Proceedings of the Advisory Council, Malayan Union, 1946* (Kuala Lumpur, 1948), pp.B108-9.
8. *Report of the Rice Production Committee, 1953,* pp.109-11.

minimum price for the padi grown.[1] The money subsidy, offered at a time when the cost of living was much lower, is now considered to be quite inadequate. The peasant in trying to provide for his family during the first few years before his crops can be harvested often has no option but to borrow money from money-lenders at high rates of interest, thus placing himself in debt from the very commencement.[2]

Because of the harsh pioneering conditions, it has become increasingly difficult to find colonists to occupy new padi lands, especially when other forms of agriculture are much more remunerative and do not entail heavy physical labour in difficult waterlogged land.[3] As Bauer points out, the smallholders who are reluctant to plant padi generally have good reasons for their hesitancy, such as excessive weather and pest risks, strenuous work, and poor yields.[4] The peasants in some cases continue to plant padi only because their land has been alienated for that purpose, and they have no alternative but to do so or else lose the land.

Yet simultaneously with the decline of peasant interest in padi cultivation, the need for more rice to feed the growing population has inrceased. Malaya has to import about half of her total rice requirements each year (Fig. 26). Rosemary Firth has emphasized the dangers of the social disorder that would arise should rice imports cease. For those peasants engaged in fishing or rubber planting, and who depend upon purchased rice for their subsistence, a rice shortage would seriously affect their nutritional standards.[5]

In view of the limited area of potential padi-land, the reluctance on the part of the peasants to settle on new land, the inadequate financial resources as well as the high cost of developing new land,[6] it would appear that increasing yields on existing padi lands offers the best possibilities of raising

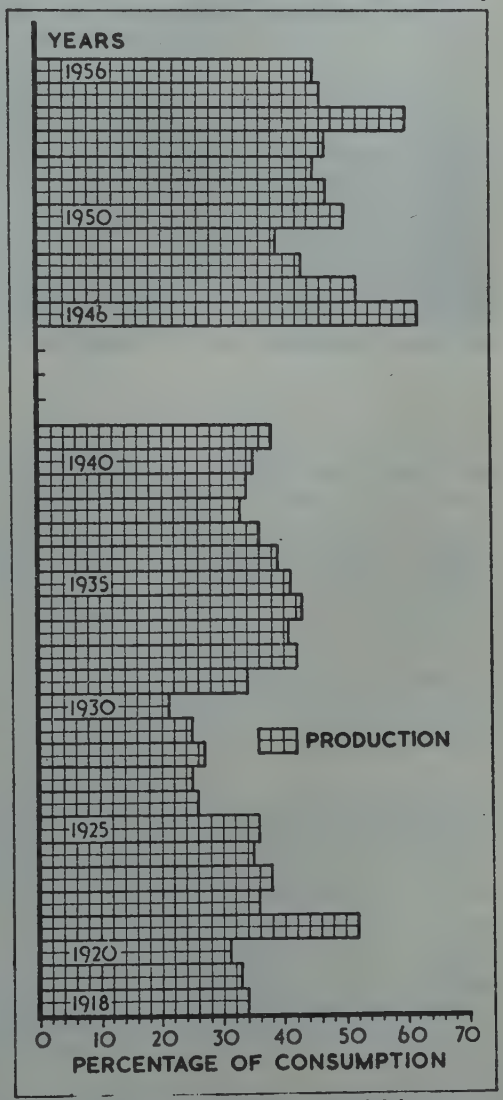

Fig. 26. Production of Rice in Malaya as a Percentage of Total Consumption.

1. *Federation of Malaya, Annual Report of the D.I.D., 1948,* pp.26-7.
2. *Report of the Rice Production Committee, 1953,* pp.15, 39-40.
3. *Proceedings of the Fed. Leg. Co., March 1953-January 1954* (Kuala Lumpur, 1954), p.169.
4. P.T. Bauer, *Report on a Visit to the Rubber Growing Smallholdings of Malaya, July-September 1946* (London, 1948), p.19.
5. *Housekeeping among Malay Peasants* (London, 1943), pp.53-5.
6. For an analysis of the cost factor in the development of new padi lands, see *The Economic Development of Malaya,* pp.72-5.

padi production. The intensification of yields in existing padi areas is also the most direct way of raising peasant production and standards of living. But the realization of this end involves more than the improvement of physical conditions of cultivation. It involves the provision of better transport facilities, better marketing arrangements, and improved social amenities to counteract the tendency to migrate from the rural areas to the towns. It is doubtful, however, in view of the small area of land cultivated by each peasant and the unfavourable climate, whether yields can ever be intensified to the point where the peasant can gain a substantial income from his labour. Also, it must be remembered that he does not work for more than six months in a year at padi cultivation, and 'to expect twelve months' good living from six months' work is to expect too much, however hard this six months' toil in the "sawahs" may be'.[1] A surplus, and not mere subsistence production, is needed to raise the standards of living. At present, with six months' labour, the peasant cannot hope to produce more than sufficient for subsistence. It is as much a sociological as an economic problem to induce a community, whose pattern and rhythm of life are bound up with the seasonal activities of padi-planting and its long period of leisure, to forego this leisure in order to produce that surplus necessary for higher material standards of living.

1. Editorial, *Straits Times*, 20th January, 1956.

CHAPTER VI

PEASANT PRODUCTION OF COMMODITIES FOR CASH

THE FIRST tropical crops to enter international trade were those which the peasants grew for their own use. Later, as the tropics became a major source of raw materials, new crops were introduced and subsequently taken up by the indigenous farmers. Rubber, which was brought to Malaya during the last decade of the nineteenth century, is a good example of such an exotic introduction. In some cases, however, a subsistence crop became also an important revenue crop, and the surplus produced by the peasant was sold, some being exported. With the greater variety of tropical crops entering the export markets, the peasant has a wider choice in dividing his effort not only between subsistence and cash-crop production, but also in deciding which crop should form the mainstay of his cash earnings.

The need for money to pay taxes and rent, to fulfil social wants and to pay for a whole range of new material goods, is usually the driving force behind the entry of the peasant into the monetary economy. To satisfy these needs and desires some members of the peasant community may have to work as labourers or wage-earners, often in far off places, thus contributing to a weakening of the social ties and tending to promote individualism. Subsistence production, which depends upon a closed system of exchange of goods within the community, gradually begins to give way to production for the market. The transition has taken place in most parts of the tropical areas, and the change involved is precipitating what Firth calls 'a crisis of the peasantry'. This crisis, he states, 'is occurring not simply because of the peasant's low standards of productivity and of living . . . but also because of the strains thrown upon his social mechanism by his and other people's efforts to raise those standards.'[1]

The extent to which subsistence production has been superseded by production for the market varies enormously from region to region. In tropical Africa, for instance, an indicator of the change over is the area of land devoted to cash-crops as compared with that under subsistence crops. Table 34 shows the situation between 1947 and 1952. The area of land under export and part-export crops was less than one quarter of the total crop area. The change over to export production was most marked in the Gold Coast, which had 45 per cent of its area devoted to export crops. All other territories had less than 30 per cent of their land under cash-crops, and in Southern Rhodesia the change over was negligible even up to 1950.

The material standards of living of the peasants who specialize in production for the market are largely determined by their money income, which is in turn determined by the prices they are able to obtain for their commodities, and by the amount they are able to produce and sell. But because prices are the result of external factors largely beyond the peasant's control, their living standards depend ultimately on the amount they are able to produce. In order to raise these standards

1. R. Firth, *Elements of Social Organisation* (London, 1951), p.12.

it is necessary to increase the average amount which a peasant can produce. The problems of doing this will be discussed here in connection with peasant fishing and rubber growing in Malaya.

TABLE 34: CLASSIFICATION OF AREA UNDER INDIGENOUS CULTIVATION IN TROPICAL AFRICA

TERRITORY & PERIOD	TOTAL AREA (THOUSAND ACRES)	PERCENTAGE OF AREA UNDER CROPS GROWN MAINLY FOR EXPORT	PERCENTAGE OF AREA UNDER CROPS GROWN PARTLY FOR EXPORT AND PARTLY FOR LOCAL CONSUMPTION	PERCENTAGE OF AREA UNDER CROPS GROWN MAINLY FOR LOCAL CONSUMPTION
BELGIAN CONGO 1947-50	5,466	2	27	71
FRENCH EQ. AFRICA, 1948-50	3,426	21	2	77
FRENCH W. AFRICA, 1947-49	23,682	3	16	81
GOLD COAST, 1950	3,982	45	—	55
KENYA, 1947-50	914	—	5	95
NIGERIA, 1950	21,309	3	22	75
SOUTHERN RHODESIA, 1950	2,253	—	—	100
TANGANYIKA, 1952	6,017	6	3	91
UGANDA, 1948-50	6,261	28	—	72
TOTAL	73,310	8	14	78

Source: Adapted from U.N., *Enlargement of the Exchange Economy in Tropical Africa*, Table 1, p. 11.

PROBLEMS OF FISH PRODUCTION IN MALAYA

While part-time fishing has always been an integral feature of the Malay subsistence economy, fishing did not become a regular full-time occupation until the turn of the century, when, in response to the demand for fish by the greatly increased Asian population, most of the coastal communities began to specialize in catching fish for the local markets. In 1947 there were 60,000 fishermen in the Federation of Malaya, of which 41,000 were Malays and 18,000 Chinese, and the remaining 1,000 were of other races.[1] In marketing their catches and purchasing their necessities, including rice, clothing, oil, paint, twine, nails, and other articles, the fishermen participate to a large extent in the monetary economy.

The fishing industry within the Malayan economic framework, though a minor one compared with tin and rubber, plays an important part in that it makes a valuable contribution to local food supplies.[2] Fish, dried, salted or fresh, is the second staple food in the diet of the Asian communities, and is eaten with rice. It is the cheapest source of protein in a country where meat is scarce and expensive. The per capita consumption of fish in 1954-55 was estimated at 2.5 oz. a day (53 lb. per annum), an amount considered nutritionally inadequate.[3]

1. del Tufo, op. cit., Table 78, p.442.
2. The gross value of fish production is nearly equal to that of domestic rice.
3. *The Economic Development of Malaya*, p.325. In 1950 it was estimated that the population of Malaya consumed only one-third of the amount of fish required to maintain a balanced diet.

Most of the Malayan fish production is derived from marine sources (Table 35). Freshwater fishing is almost entirely a part-time peasant occupation, and only 15.5 per cent of the fish landed in 1948-49 was of freshwater origin.

TABLE 35: PRODUCTION OF MARINE AND FRESHWATER FISH IN MALAYA, NOVEMBER 1948 TO OCTOBER 1949

	PRODUCTION IN TONS	PERCENTAGE
MARINE FISH		
OFFICIAL COMMERCIAL LANDINGS	81,880	56
PERSONAL CONSUMPTION	23,000	16
FISH SOLD AS MANURE	18,250	12·5
FRESHWATER FISH		
COMMERCIAL LANDINGS	7,142	5
PERSONAL CONSUMPTION	15,200	10·5
TOTAL	145,472	100

Source: *Annual Report of the Fisheries Department, Federation of Malaya and Singapore, 1949* (Singapore, 1950), p. 8.

Freshwater Fishing. Of the 89,022 tons of fish sold in the Malayan markets in 1948-49, only 7,142 tons were of freshwater origin. Throughout Malaya, rivers, ponds, lakes, catchment areas, fresh-water swamps and abandoned mining pools are fished regularly by Malay peasants and Indian labourers. This is a part-time occupation, and the catch seldom goes beyond the home or the nearest village market. Chinese participation in freshwater fishing is confined to carp rearing in artificially constructed ponds, which forms an integral part of the Chinese market-gardening-cum-fish-rearing landscape. The carp fry is imported from China as the fish do not breed locally.[1] Production is only a few hundred tons a year. In 1954 an estimated 3,000 acres of land were devoted to this form of pisciculture.[2]

Freshwater fish for the home and for the market are caught in the fields, irrigation canals and drains in the padi-growing areas. Fish are found in most padi-fields, but in the small and discontinuous fields characteristic of the south Malayan padi landscape, fish are caught for subsistence, and only in the large continuous plains of north Malaya are there substantial surpluses above subsistence needs. The four most important varieties of padi-field fish are *Trichogaster trichopterus* (Malay: sepat ronggeng), *T. pectoralis* (sepat siam), *Ophiosephalus striatus* (aruan) and *Claricas batrechus* (keli). All are labyrinth fish capable of absorbing atmospheric oxygen when their gills are wet and of surviving extremes of temperature and oxygen availability. There is always a sufficient number of fish left in the drains and canals to supply the next season's fry, so that no re-stocking is necessary.

The 'sepat siam' is exported as salt fish, the others are eaten fresh. The 'sepat siam', a prolific and hardy fish, was introduced into the Krian Irrigation Area about 1921 and has since spread to all other padi areas. Feeding on silt, algae and other vegetation, the fish enter the fields when they are flooded for transplanting, and they mature there after four months. When the irrigation water is drained off before the harvest, the fish collect in the specially dug sump-ponds

1. W. Birtwistle, 'Rearing of Carp in Ponds', *M.A.J.*, Vol. XIX, No. 8, 1931, pp.372-83.
2. D.W. le Mare, 'Malaya's Fish Industry', *Malaya*, July, 1954, p.393.

(Malay: 'telagas') at the lowest part of the fields. Each 'telaga' may drain two or three acres, and the yield varies between 40 lb. and 1,333 lb. of fish per 'telega'.[1] There were about 14,500 'telagas' in Krian in 1949, and most of the salted 'sepat siam' exported each year comes from this area.[2] The surplus fish are sold and provide an important source of extra income to the padi-planter. It has been calculated that the income from fish was enough to pay the water rate and the rent, and in a few instances it was as much as the peasant could obtain from selling his padi crop.[3] Krian offers exceptionally good conditions for the fish to breed, but in most of the other padi areas production is barely sufficient for subsistence.

It is clear that if fish production in padi-fields could be intensified to the point where the peasant is able to obtain a regular surplus, his income level would be raised one step higher, and with this aim in view attempts have been made to popularize the *Tilapia mossambica* among Malay planters. This fish, which is indigenous to Mozambique, was introduced by the Japanese into the Malay Peninsula during the war. An indiscriminate feeder (as well as being hardy enough to be able to live in both brackish and fresh water), the *Tilapia* when fed experimentally on rice bran, chopped tapioca leaves and refuse, yielded up to 1,000 lb. per acre per annum. It appeared to be an excellent fish to stock in the padi-fields, but it was discovered that other predator fish, notably the 'aruan', were a serious menace to the young *Tilapia* fry.[4] Another drawback was that the fish was too small, and its growth rate too slow, for it to be of much value for breeding in the fields.[5]

Marine Fishing. Whereas freshwater fishing is only one complementary facet of the peasant padi economy, marine fishing is more nearly a self contained industry. In much the same way that padi cultivation dominates the peasant economy in the coastal alluvial plains, so sea fishing dominates peasant life along the extensive coastline on both sides of the Peninsula, with the difference that full-time fishing is more closely associated with the monetary economy than padi cultivation because the fisherman, unlike the padi-planter, cannot subsist on his catch alone.

The number of fishermen has fluctuated considerably in post-war years, rising steadily from 60,000 in 1947 to a peak of about 77,700 in 1950, and subsequently declining, because of poor fishing seasons, to 49,500 in 1954.[6] Table 36 shows the distribution and nationality of the fishermen in 1954. Malays outnumbered all the other races, and constituted 69 per cent of the total fishing population. They were predominant in the east coast States of Pahang, Trengganu and Kelantan, and the west coast States of Malacca, Kedah, and Perlis. Perak, Selangor and Negri Sembilan had Chinese majorities. Johore and Penang and Province Wellesley had nearly equal numbers of Chinese and Malay fishermen.

The form and nature of fishing activities are conditioned to a large extent by climate and hydrography. Fishing on both sides of the Peninsula is usually

1. *Annual Report of the Fisheries Department, Federation of Malaya and Singapore, 1948* (Singapore, 1949), pp.27-9.
2. *Annual Report of the Fisheries Department, Federation of Malaya and Singapore, 1949* (Singapore, 1950), p.87.
3. R.G. Heath, 'Fish Production in the Krian Irrigation Area', *M.A.J.*, Vol. XXII, No. 4, 1934, pp.186-8.
4. *Annual Report of the Fisheries Department, Federation of Malaya and Singapore 1949*, pp.62-4, 70-1, 138.
5. The *Singapore Standard*, 22nd September 1955.
6. *The Economic Development of Malaya*, Table 2, p.327.

restricted to the continental shelf, and does not normally extend beyond ten miles from the coast. About twenty main varieties of edible marine fish are normally caught, although there are more than 250 species of such fish in Malayan waters.[1] The daily cycle of fishing activities relates closely to the incidence of land and sea breezes. Superimposed upon this is the seasonal cycle along the east coast as determined by the North-east Monsoon, and along the west coast by the South-west Monsoon, though the Monsoon on the west coast is not strong enough to hamper fishing to any great extent. Fishing stakes cannot be erected along the east coast because of the strength of the North-east Monsoon, but in the calmer waters off the west coast, stakes and weirs are important complements of the fishing techniques.[2] The fish are landed at more than 300 points along the coast of the Peninsula.[3]

TABLE 36: NUMBER, DISTRIBUTION AND NATIONALITY OF FISHERMEN IN MALAYA, 1954

STATE	MALAYS	CHINESE	OTHERS	TOTAL
KELANTAN	6,417	1	2	6,420
TRENGGANU	12,090	—	1	12,091
PAHANG	3,477	39	—	3,516
JOHORE	2,044	1,863	—	3,907
MALACCA	1,267	970	69	2,306
NEGRI SEMBILAN	178	335	2	515
SELANGOR	851	3,894	38	4,783
PERAK	1,577	5,023	182	6,782
PENANG & P. WELLESLEY	2,370	2,327	141	4,838
KEDAH	2,808	611	245	3,664
PERLIS	600	110	—	710
TOTAL	33,679	15,173	680	49,532

Source: *Federation of Malaya, Annual Report, 1954*, p. 155.

Malay fishermen's houses usually form ribbon settlements parallel with the shore. Along the east coast they are situated on the inner face of the permatangs, or behind rocky outcrops and ridges, which afford protection against the North-east Monsoon. In western Malaya the muddy mangrove shoreline does not make for good settlement sites, and fishing villages are often of the 'bagan' type, that is, nucleated settlements with houses on high stilts built over the mud and isolated from the mainland at high tides.

Little information is available about the fisherman's standard of living as indicated by his cash income. Sir Richard Winstedt in 1939 estimated that the net earnings of the individual fisherman on the east coast was $8.75 a month, and on the west coast $10.14, as compared with $12 to $15 earned by a rubber estate labourer, and $137 to $171.40 that a rubber smallholder with five acres of land could earn in a month.[4] Firth's pre-war estimates showed that the fishermen

1. R. Firth, *Malay Fishermen: their Peasant Economy* (London, 1946), p.6.
2. For more detailed descriptions of fishing methods in Malaya, see A.K. Tham, 'Methods of Fishing', *Malayan Fisheries* (Singapore, 1949), pp.47-58; and R.J. Wilkinson and Others, *Report on the Fishing Industry of the Straits Settlements and Federated Malay States on the West Coast of the Peninsula* (Kuala Lumpur, 1904), App. I.
3. *The Economic Development of Malaya*, p.331.
4. Sir Richard Winstedt, *The Malays: a Cultural History*, p.123.

earned an average of $11 per month as compared with $12 to $15 earned by the rubber estate labourer. He also stated that the fisherman's income was higher among the Chinese than among the Malays, and that it was higher along the west coast than along the east coast.[1] Burgess and Laidin bin Alang Musa found, in their post-war survey, that the fishermen had less to eat than the smallholder and labourer, and that at times they suffered actuely from hunger. The net income per month of the fishermen in Malacca varied from $34 in November 1948 to $64 in February 1949. In comparison, the monthly earning of the estate labourer was $97, while that of the padi-planter varied from $48 to $102.[2] The available evidence indicated that the fishermen had the lowest levels of living as judged by their incomes and their diet. The position is worst along the east coast. The Minister for Agriculture admitted in 1955 that the economic status of the 100,000 fishermen and their families on the east coast was bad.[3] In 1948 a member of the Federal Legislative Council had drawn attention to the low standards of living of the fishermen in Trengganu (the State with the largest fishing population), stating that only a small minority of them were living above the hunger line.[4]

Experts have affirmed that availability of fish was not a limiting factor to increased fish production, and that the prospects of expansion in the fishing industry were good.[5] The demand for fish remains strong, and the International Bank Mission points out that the high prices prevailing in Malaya are an indication that supplies are below demand, and that a sellers' market exists.[6] It would appear that the easiest and quickest way to increase the fisherman's income, and hence his standard of living, would be through an increase in output.

TABLE 37: AVERAGE PRODUCTION OF FISH PER PERSON PER ANNUM IN MALAYA, 1948-49

STATE	TOTAL PRODUCTION (LB.)	NUMBER OF FISHERMEN	PRODUCTION PER FISHERMAN (LB.)
KELANTAN	13,360,000	7,022	1,902
TRENGGANU	20,708,000	30,322	684
PAHANG	15,348,000	3,442	4,460
JOHORE	12,640,000	3,344	3,780
MALACCA	5,813,000	2,691	2,160
NEGRI SEMBILAN	333,000	485	687
SELANGOR	14,720,000	5,609	2,624
PERAK	41,628,000	7,257	5,736
PENANG	10,920,000	5,842	1,896
KEDAH	17,988,000	3,613	4,940
PERLIS	6,108,000	1,262	4,840
TOTAL/AVERAGE	159,566,000	70,889	2,250

Source: *Annual Report of the Fisheries Department, 1949*, p. 10

1. Firth, *Malay Fishermen*, pp.15, 17, 277-81.
2. Burgess and Alang Musa, op. cit., pp.33, 51, 53, 63, 68. For more details on the monthly incomes of Malayan peasants, see *Federation of Malaya, Final Report of the Rice Committee*, pp.64-7; and the *Straits Times*, 28th February, 1957.
3. The *Singapore Standard*, 22nd September, 1955.
4. *Proceedings of the Fed. Leg. Co., February 1948-February 1949* p.B107.
5. G.L. Kesteven (ed.), *Malayan Fisheries* (Singapore, 1949), p.70; also Firth, *Malay Fishermen*, p.30.
6. *The Economic Development of Malaya*, pp. 330-1.

The Fisherman's Output. The Malayan fisherman's output is very low. As early as 1923, Stead had drawn attention to the very small catch per man.[1] Firth calculated that the Malay fisherman produced an average of 1.5 tons of fish per annum. The output of the British fisherman was six to eight times larger in bulk, and twelve to fifteen times higher in value.[2] The situation in the post-war period is shown in Table 37. Several factors responsible for the low output will now be considered.

(1) Climate. The high seas and bad weather associated with the Monsoons exert a strong influence on fishing activities, and induce a seasonal drop in production along both coasts. The drop in production on the east coast between December and March coincides with the North-east Monsoon, and the drop between July and October on the west coast coincides with the South-west Monsoon (Fig. 27).

(2) Migration and Size of Fish. The output of fish varies with the presence or absence of fish shoals. It has been established that the principal types of pelagic fish along the west coast could only be caught during certain periods of the year.[3] 'Kembong' (a type of mackerel) can be located only during dark moonless nights when the phosphorescence caused by the movement of the shoals is visible, so that on the clear nights the catch may fall considerably.[4] Another reason for the small catches of the Malayan fishermen may be the size of the fish. The bulk of the fish are small even when fully matured.[5]

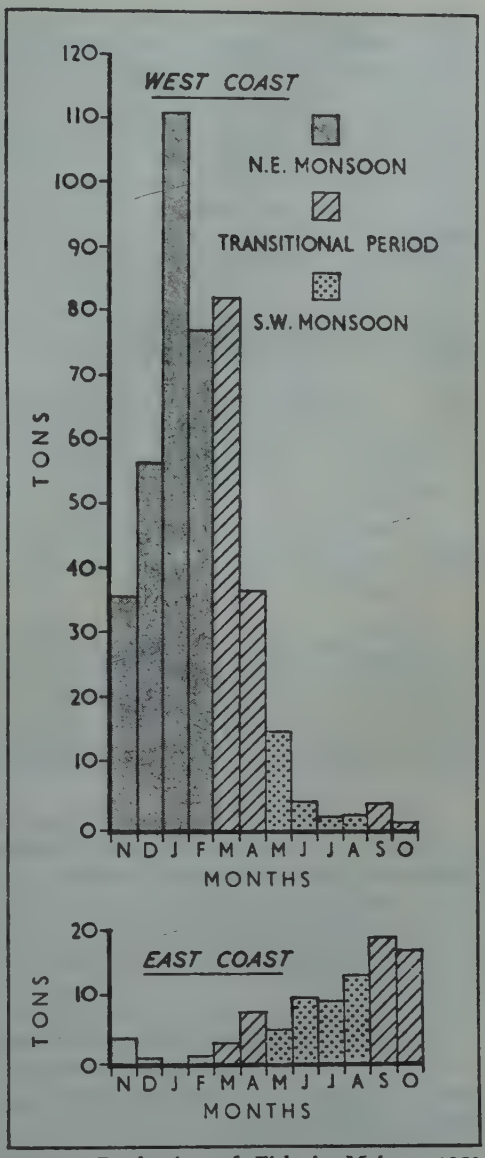

Fig. 27. Production of Fish in Malaya, 1950.

(3) Lack of Mechanized Fishing Craft. The use of traditional small craft propelled by oars, paddles and sails restricts fishing to a narrow off-shore zone,

1. D.G. Stead, *General Report upon the Fisheries of British Malaya* (Sydney, 1923), pp.65-6.
2. Firth, *Malay Fishermen*, p.6, and 'The Peasantry of South-east Asia', pp.504-6.
3. C.N. Maxwell, *Preliminary Report on the Economic Position of the Fishing Industry of the Straits Settlements and Federated Malay States* (Singapore, 1921), App. A, p.12.
4. *Annual Report of the Fisheries Department of the Straits Settlements and the Federated Malay States, 1937* (Singapore, 1938), App. A, pp.6-8.
5. *Annual Report of the Fisheries Department of the Straits Settlements and the Federated Malay States, 1935* (Kuala Lumpur, 1936), p.3.

and reduces the quantity and variety of the fish caught. It is significant that in Perak, where 212 out of the total of 327 powered boats in Malaya in 1948-49 were operating, the average output was the highest in the Federation, while in Trengganu, where the output was the lowest, none of the 4,589 boats were mechanized.[1] A comprehensive examination of the working efficiency of motorized and non-motorized fishing units revealed that the former could maintain a high and steady rate of production, which could only be achieved by the latter at peak periods.[2] Boat mechanization can also increase production by making possible the fishing of grounds now beyond the reach of traditional craft.[3] Fishermen at present cannot venture more than ten miles off the east coast or twenty miles off the west coast. Although considerable progress has been recorded in the change over to mechanized craft since 1947, more than 80 per cent of the fishing units in 1954 were still non-powered, as may be seen in Table 38.

TABLE 38: PERCENTAGE OF POWERED FISHING BOATS IN MALAYA, 1947-54

YEAR	TOTAL NUMBER OF BOATS	NUMBER POWERED	PERCENTAGE OF TOTAL
1947	16,215	114	0·7
1948	19,692	191	1·1
1949	21,793	327	1·5
1950	22,804	811	3·5
1951	20,905	709	3·4
1952	22,585	1,775	7·8
1953	22,607	1,570	7·0
1954	21,839	4,052	19·0

Source: *Malayan Statistics, No. 5, 1956* (Singapore, 1956), p. 46.

The percentage of powered boats in Malaya rose from less than 1 per cent in 1947 to 19 per cent in 1954. Mechanization has proceeded furthest in the west coast States where the Chinese are concentrated. Eighty-nine per cent of the total number of powered craft in use in 1954 were in the States of Penang, Perak, Selangor, Negri Sembilan, Malacca and Johore, while the other 11 per cent were in the predominantly Malay States of Perlis, Kedah, Kelantan, Trengganu and Pahang.[4]

Seasonal Unemployment. Due to the seasonal variations in production and also because of his low income, the fisherman has to find some other means of tiding over the periods of enforced leisure when he is unable to go to sea. There are three possibilities open to him. Firstly, he may try to save a certain portion of his income earned on the days he goes out fishing, and put that aside for use

1. *Annual Report of the Fisheries Department, 1949*, Summary II, p.30.
2. *The Economic Development of Malaya*, p.328.
3. Four potential fishing grounds have so far been discovered, but they all lie beyond the range of the traditional craft. Three of them are off the east coast: one running across the mouth of the Gulf of Siam: the second running east-west twenty miles off the Pahang coast, and the third extending north-south about eighty miles off the Trengganu coast. The other grounds extend in an are between the Langkawi Islands to the north of Penang and the northern tip of Sumatra. The search for new fishing grounds is being expanded to include areas as far away as the Andaman Islands, the Sulu Sea, and Borneo. *The Economic Development of Malaya*, p.329. The *Straits Times*, 22nd October, 1954.
4. *Federation of Malay, Annual Report, 1954*, p.155.

during the off-days. Firth discovered that about one fifth of the fishing population in the Peropok area of Kelantan had a surplus above the daily domestic needs which could be put by as savings, the others were unable to save anything.[1] Secondly, he may borrow money and goods from the fish dealer or shopkeeper. This is a common way out. Finally, he may try to earn some money by working in secondary occupations. This again is commonly done. The fisherman may take on any of the other rural occupations. An examination of the secondary occupations of sixty-two fishermen in Peropok showed that thirty-two men were cultivating padi and doing other forms of agricultural work, thirteen were engaged in making nets and boats for sale, ten were fish dealers, and the rest were occupied in a number of miscellaneous jobs.[2]

The ability to supplement income by alternative occupations depends on the opportunities for other employment, that is, on the proximity of the fishing village to cultivable land, to a rubber or coconut estate, to a mine or a town. The very sandy soil along the Pahang coast, for instance, makes agriculture almost impossible, and the fishermen there have to find some form of non-agricultural work, such as rattan-collecting and mat-making, during the off-season. The standards of living of the fishermen are, therefore, related to the availability of alternative sources of income during the off-season as well as to variations in the fish output. In an area where the fish output is small, and off-season employment opportunities are limited (as in Pahang and Trengganu), the fishermen's living standards are correspondingly low.

Government Assistance to Fishermen. The provision of governmental assistance to fishermen is a recent event. Before the last war there was a general lack of interest in the fishing industry. There was no knowledge of the distribution or economic importance of different types of fish, or of the types of gear needed to capture them, and there was no organisation in existence to find out this information.[3]

The creation of a Malayan Fisheries Department after the war was an important development. But work has been hampered by the lack of staff. The Director himself has pointed out the anomalous situation which prevailed in Trengganu. This State which had the largest number of fishermen in Malaya did not have a single Fisheries Officer until the end of 1948.[4] As late as 1951 there was only one Fisheries Officer in Pahang, who had to run the administrative side of the State Fisheries Department as well as go to sea. Up to 1954 vital specialists' posts connected with research on marine and freshwater fisheries, with the economics of marketing, distribution, processing and handling, were unfilled because of insufficient funds and personnel.[5]

Direct attempts by the Federal Government to alleviate the hardships of the fishing population have been few and far between. A start has, however, been made. A fish marketing scheme financed by Colonial Development and Welfare funds was started in Kelantan, and fishermen were guaranteed a fixed price for their catch.[6] Another project, designed to cope with the glut of low grade fish at certain seasons, entailed processing the fish on the spot and converting them into

1. Firth, *Malay Fishermen,* pp.258-81.
2. Ibid., Table 4, p.78; also Burgess and Alang Musa, op. cit., pp.65-6.
3. Stead, op. cit., pp.15, 62, 63, 99.
4. *Annual Report of the Fisheries Department, 1948,* p.55.
5. *The Economic Development of Malaya,* p.334.
6. *Federation of Malaya, Weekly News Summary* for the week ending 26th February, 1955, p.8.

fertilisers.[1] A more ambitious scheme involving $3,000,000 to improve the living conditions of the 1,500 Chinese fishermen's families at Pangkor Island was also being considered.[2]

A special Federal committee was appointed in June 1955, to study the economic conditions of fishermen in Malaya with a view to fixing minimum wage levels for fishermen, providing credit facilities to save them from endless indebtedness, establishing marketing boards to eliminate monopolies, and co-operatives to supply food, clothing and fishing equipment at moderate prices.[3]

Not the least of the many problems which face the authorities is the dissemination of information on practical and technical subjects to the fishing communities living in scattered and isolated villages. The use of printed material is of little value when the literacy rate is very low. Personal contact and instruction are hampered by the lack of Fisheries staff, and by the nature of the fishermen's work which takes them out to sea for long periods. There is also the problem of resistance to change and to the adoption of modern fishing methods. Any changes in the industry can only be achieved through corresponding changes in the life and social institutions of the peasants. To widen the basis of the fishing economy and to increase production and standards of living such changes are necessary, but it is evident that they can only come about gradually and after heavy expenditure of money and effort.

PEASANT PROBLEMS OF RUBBER PRODUCTION IN MALAYA

The Growth and Characteristics of the Rubber Smallholding Industry in Malaya. The history of peasant participation in rubber cultivation in Malaya follows closely the introduction of the first rubber seedlings into the country in 1876. Rubber was first grown as a commercial proposition in Malacca, and was soon taken up by planters in other States. From 1905 the Federated Malay States Government began to record the amount of rubber exported, and 105 tons were shown to have been sent from the Federated Malay States in that year. In 1911 the total area of rubber plantations in Malaya was 543,000 acres. By 1920 the export of rubber reached 196,000 tons, or 53 per cent of the world production.[4]

While the European planters concentrated on the cultivation of rubber in large estates run with imported Indian labour, the Chinese took to growing it in smaller holdings. The Malay peasants, attracted by the enormous profits, also began planting the tree. In some cases they cut down their fruit trees, and even planted their padi-fields with rubber.[5] In others, especially where the immigrant Malays were concerned, they cleared and opened up new land. The boom in rubber planting by smallholders started about 1910.[6]

Rubber cultivation was considerably facilitated by the ease with which new land could be acquired. Restrictions on new planting and on land acquisitions were not imposed until the depression of 1920-22.[7] When a new land law in

1. The *Singapore Standard,* 23rd October, 1954.
2. The *Straits Times,* 19th October, 1954.
3. The *Straits Times,* 2nd June, 1955.
4. D.H. Grist, *An Outline of Malayan Agriculture* (Kuala Lumpur, 1936), pp.73-4; Marks, op. cit., pp.281-5, 292; Jenkins, op.cit., pp.296-9 and 329-37; and Wright and Reid, op. cit., pp.288-9, 292.
5. Sir Richard Winstedt, *The Malays: a Cultural History,* p.127.
6. The *Straits Times.* 25th February, 1956.
7. Bauer, *Report on a Visit to the Rubber Growing Smallholdings of Malaya, 1946,* p.14.

Johore was passed in 1910 giving security of title, there was an immediate rush to take up the land for rubber, and more than 10 per cent of the State area was acquired by smallholders and estate owners between 1912 and 1915.[1] The fact that the tree would grow in any part of the Peninsula below an elevation of 1,000 feet, (although optimum conditions were found only on well-drained land with even and heavy rainfall,) also greatly facilitated the development of the rubber industry in Malaya.

Though hampered greatly by the governmental policy discouraging and sometimes prohibiting new planting, which was in force from 1922 to 1947, the smallholders continued to extend their rubber areas. Before 1921 they had already planted 800,000 acres. Between 1921 and 1925 they increased this area by 320,000 acres, between 1926 and 1930 by 240,000 acres, between 1931 and 1941 by 192,000 acres, between 1942 and 1946 by 28,000 acres, and between 1946 and 1953 by 120,000 acres. The total area planted by smallholders in 1953 was 1,698,000 acres, or 45.5 per cent of the total Malayan acreage, the other 54.5 per cent was cultivated in estates.[2]

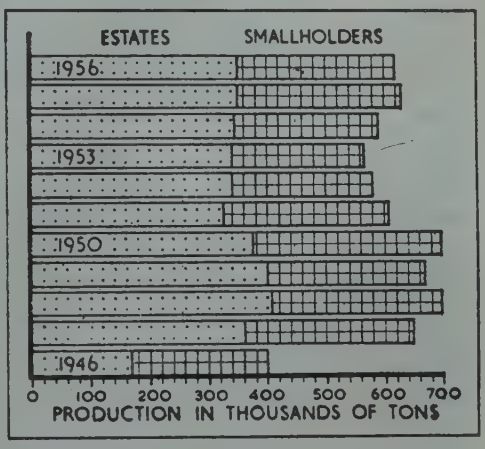

Fig. 28. Rubber Production by Estates and Smallholders in Malaya.

The importance of the smallholder production in the rubber industry of Malaya can be appreciated from Fig. 28. It will be seen that smallholder production in the post-war period has remained between 40 and 45 per cent of the total Malayan production. In 1946 the greater flexibility of the smallholder industry enabled it to recover faster from the neglect of the war years, and smallholders were able to produce nearly 57 per cent of the rubber that year. By 1947, however, estate efficiency was restored, and the balance of production swung round in the estates' favour.

The estates are owned and controlled largely by an immigrant population. In 1953 the area under European control was 1,412,400 acres, or nearly 70 per cent of the total Malayan estate acreage. The Chinese owned 462,100 acres (23 per cent), the Indians 113,200 acres (5 per cent) and the other races, including the Malays, 41,950 acres (2 per cent).[3]

The distinction between an estate and a smallholding is fairly clear-cut. Estates are homogeneous units of 100 acres or over, operated with a paid labour force, and financed by substantial capital. Official statistics group all holdings below 100 acres as smallholdings. There are, however, two distinct kinds of smallholding. There are the 'medium holdings' with an average area of forty-four acres, and the 'peasant holdings' with an average area of three and a half acres.

1. *Report of the Survey Departments of Malaya, 1935* (Kuala Lumpur, 1936), Pt. iv., App. 1, pp.55-6.
2. R.F. Mudie and Others, *Report of the Mission of Enquiry into the Rubber Industry of Malaya* (Kuala Lumpur, 1954), App. C., p.68.
3. *Rubber Statistics Handbook, 1953* (Kuala Lumpur, 1954), Table 8, p.19.

The medium holdings resemble the estates in that they are tapped with the aid of contract or paid labour, whereas the peasant holdings are usually run on a family basis. Also the larger holdings are like the estates in the orderly way in which the trees are planted, and in their having a central nucleus of buildings in which the labourers are housed. The smaller holdings present a more ragged appearance, with the trees planted haphazardly in the midst of tall undergrowth, so that from the air it is difficult to distinguish the holdings from the surrounding jungle.

TABLE 39: AREA, DISTRIBUTION AND AVERAGE SIZE OF RUBBER SMALLHOLDINGS IN MALAYA, 1953

STATE	PEASANT HOLDINGS (UNDER 25 ACRES)			MEDIUM HOLDINGS (25-99 ACRES)			TOTAL PLANTED ACREAGE
	NUMBER OF HOLDINGS	PLANTED ACREAGE	AVERAGE SIZE OF HOLDING (ACRES)	NUMBER OF HOLDINGS	PLANTED ACREAGE	AVERAGE SIZE OF HOLDING (ACRES)	
PERAK	87,625	266,600	3·0	798	44,908	56·2	311,508
SELANGOR	40,985	151,016	3·7	692	35,216	50·9	186,232
NEGRI SEMBILAN	31,286	92,703	2·9	1,067	38,443	36·0	131,146
PAHANG	22,959	108,439	4·7	512	17,569	34·3	126,008
MALACCA	19,789	59,585	3·0	599	29,366	49·0	88,951
PENANG & PROV. WELLESLEY	5,813	22,917	3·9	155	6,696	43·2	29,613
JOHORE	98,240	440,919	4·5	1,979	99,602	50·3	540,521
KEDAH	28,209	113,769	4·0	1,125	32,358	28·7	146,127
PERLIS	1,883	4,752	2·5	3	194	64·7	4,946
KELANTAN	36,540	80,463	2·2	73	3,022	41·4	83,485
TRENGGANU	11,879	37,468	3·1	271	11,829	43·5	49,297
TOTAL/AVERAGE	385,208	1,378,631	3·5	7,274	319,203	44·0	1,697,834

Source: *Rubber Statistics Handbook, 1953* (Kuala Lumpur, 1954), Table 28 (i), pp. 77-81.

It is proposed to use the term 'peasant holdings' when referring to those holdings below twenty-five acres in size, and 'medium holdings' for those between twenty-five and ninety-nine acres, and 'smallholdings' as a portmanteau term to cover both. Since this study is concerned particularly with peasant problems, attention will be focussed on the peasant holdings, which constitute the bulk of the smallholdings. Of the total smallholding acreage of 1,697,800 acres in 1953, 81 per cent came under the peasant holding category.[1]

As Table 39 indicates, a large proportion of the peasant holdings is located in the western States south of Penang and Province Wellesley. Of the 385,208 separate peasant holdings in Malaya, 226,850 (59 per cent) were in the three States of Perak, Selangor and Johore. But rubber is ubiquitous in the Peninsula, and there are large areas devoted to the crop in every State.

1. 'Figures for smallholders' planted areas . . . are liable to very considerable error. They are based solely on the area recorded as alienated for rubber, and there has been no regular check by the Land Officers to see whether rubber was actually planted, or whether rubber has been planted on areas not alienated for rubber.' Mudie and Others, op. cit., p.5.

The average size of a peasant holding in Malaya in 1953 was 3.5 acres. The averages in the different States corresponded closely with this figure, the smallest was 2.2 acres in Kelantan and the largest was 4.7 acres in Pahang. These figures relate to the average rather than the actual size, which as defined could be anything up to twenty-five acres. A sample survey by the Rubber Research Institute of 340 peasant holdings, distributed throughout Malaya, revealed that the majority of them were less than five acres in size. Of the 340 holdings, 73.6 per cent were between one-half and five acres each, 19.7 per cent between five and ten acres, and only 6.7 per cent were between ten and twenty-five acres each.[1] An independent survey by Bauer in 1946 of the size of peasant holdings in the Kukup District of Johore showed that out of the 9,478 holdings, 96.1 per cent were less than ten acres in size.[2]

The Malayan rubber industry is divided and stratified according to nationality of ownership and area. On the one hand, at the upper end of the scale are the large European estates of up to 10,000 or more acres each. Occupying an intermediate position are the Chinese and, to a lesser extent, the Indian estates. At the lower end of the scale are the few (about 2 per cent of the total estate area) Malay and other estates. The Chinese are dominant as owners of the larger medium holdings, with the Indians and other miscellaneous races in the intermediate position, and the Malays at the lowest end of the scale. Within the peasant holdings framework, the Malays are dominant, as far as the total acreage is concerned, but their individual holdings are smaller in average size than those of the other races, as shown in Table 40. Although Table 40 is incomplete because of lack of information, it does give a good representation of the position as regards the nationality of ownership of the peasant holdings, and the average size of each holding. The Malays, as well as owning 56 per cent of the total planted acreage, had also the greatest number of holdings (66 per cent of the total 299,894), so that the average size of each Malay holding was smallest in the group. The Chinese holdings comprised 35 per cent of the total planted area. The Indians and other races, though their holdings were somewhat similar to those of the Chinese in average size, owned only 9 per cent of the total area.

TABLE 40: NATIONALITY OF OWNERSHIP OF PEASANT HOLDINGS IN MALAYA, 1953

NATIONALITY	PEASANT HOLDINGS (LESS THAN 25 ACRES)		AVERAGE SIZE OF HOLDING (ACRES)
	NUMBER	PLANTED ACREAGE	
MALAY	199,282	635,910	3·2
CHINESE	78,404	401,695	5·0
INDIAN	18,712	78,411	4·2
OTHERS	3,496	22,133	6·3
TOTAL/AVERAGE	299,894	1,138,149	3·8

Note: This table is incomplete because of the lack of information on the nationality of ownership in several States involving 85,314 separate holdings with a planted area of 240,482 acres.

Source: Rubber Statistics Handbook, 1953, Table 28 (ii), pp. 81-5.

1. H.F. Smith, 'A Sampling Survey of Tapping on Small Holdings (1939-40)', *Journal of the R.R.I. of Malaya, Communication No. 265, 1947,* Table IV, p.117.
2. Bauer, *Report on a Visit to the Rubber Growing Smallholdings of Malaya,* 1946, p.86.

The findings of the pre-war Rubber Research Institute survey were similar to those set out in Table 40. Of the 218 holdings surveyed, 72.5 per cent of them were less than four acres each, and 26.6 per cent were between four and ten acres in size. The Chinese holdings were more evenly spread out as regards their size. Of the 104 surveyed 49 per cent were less than five acres, 33.6 per cent were between five and ten acres, and the rest between ten and twenty-five acres in size.[1]

The Chinese, Indian and other non-Malay smallholders plant rubber in continuous homogeneous stands similar to the mono-cultivation practised on the European estates. The rubber trees in a Malay holding, however, are often interplanted with fruit, coconut, and other trees and bushes. The rubber trees do not form continuous stands, but are in isolated clumps of a few trees separated by other vegetation. Beyond the immediate neighbourhood of the house, the mixed stand usually gives way to a pure stand of rubber growing in the midst of tall undergrowth and rubber seedlings. The same pattern of a mixed stand facing the road, river or railway, and of a pure rubber stand in the interior, or sometimes to one side, prevails in such widely separated areas as Kuala Kangsar (Perak), Kuala Pilah (Negri Sembilan), and the Pekan riverine kampongs of Pahang.

The policy in the European estates is to maintain a limited number of trees (about 120 to 180) per acre, which are subsequently thinned out to between 80 and 100 per acre.[2] Planting on peasant holdings is very dense, with initial stands of 300 to 500 trees per acre. Smith found, in an examination of fifty-nine holdings, that thirteen of them (22 per cent) had a planting density of more than 400 trees per acre, a further thirteen of 300 to 400 trees per acre, nine of 200 to 300 trees per acre, twenty-three of 100 to 200 trees per acre, and one of a density of less than 100 trees per acre.[3] Whereas the estates aim at high yields per tree, the peasant depends on the high yields per acre that could be obtained from the denser planting. The peasant does not practise the weeding, drainage, and other cultural methods followed by the estates. With the close planting and the tall undergrowth the peasant holding approaches in appearance an abandoned jungle clearing reverting to secondary forest, differing from it only in that there is a single dominant species in the holding instead of the variegated species common in a rainforest. By duplicating jungle conditions in his holding, the peasant is following sound conservation principles, for the ground temperature in the holding is lowered and decomposition of organic matter takes place slowly, whilst an ample supply of dead organic matter is available from the trees and undergrowth. The dense shade prevents the obnoxious 'lalang' (Imperata spp.) from gaining a foothold. The soil remains undisturbed and stable and its fertility unimpaired.

In pre-war years the common opinion was that yields in peasant holdings were bound to decline rapidly because of the close planting, the neglect of tree care, and the prevalence of disease. It was thought that the high yields obtained by the peasant were maintained at the cost of excessive tapping, and of deep and careless tapping methods which would cause permanent damage to the tree, and allow Mouldy Rot (disease of the tapping panel) to advance to a stage at which the tree would be completely ruined. In order to ascertain whether the rate of tapping was in fact going on faster than the rate of bark renewal, the Rubber Research Institute, in conjunction with the Department of Agriculture, made an

1. H.F. Smith, op. cit., Table III, p.117.
2. Bauer, *The Rubber Industry: A Study in Monopoly and Competition*, pp.56, 68.
3. H.F. Smith, op. cit., p.94.

examination of ninety holdings distributed over the Peninsula. The examination was made during 1931-32, and the results showed that the commonly held view was fallacious, and that tapping was not leading to decreasing yields because it was not as excessive as believed, for the following reasons: (1) the close planting allowed the peasant to rest an average of 22 per cent of his trees for a period of at least one year during which time the bark could renew itself sufficiently;[1] (2) the peasant did not tap every day, but only on twenty days in a month, so that during the off-days the trees could renew their bark; and (3) although 30 per cent of the holdings were infected with Mouldy Rot, the effect of the disease on bark renewal was negligible. From these findings it was concluded that 'the smallholder does not, in general, tap his trees indiscriminately but in such a manner as will ensure him the yield needed to fulfil his monthly requirements.'[2]

The smallholders are low cost producers, and are in a more favourable competitive position than the estates, which have to depend on paid labour for all the cultivation work such as clearing, weeding, tapping, processing, packing and general upkeep. Included in the estate costs are management and office salaries, agencies fees, office expenses, employees' welfare benefits (including the provision of primary education for the labourers' children), rents, general transport charges, repairs and depreciation, all of which contribute heavily to the cost of production.[3] Bauer has shown that economies of scale (reduction in expenses through amalgamation of contiguous units) could be obtained for a unit of up to 5,000 acres only, so that the costs of production in estates could not be reduced very much by increasing the size of the estate.[4] The peasant smallholders, on the other hand, produce a comparable commodity with the minimum of labour and capital expenditure. The holding is usually tapped by the smallholder and his wife, or, if it is larger than ten acres, with the aid of a few share or contract tappers. The only capital expenditure necessary is for the purchase of a roller, tapping knives, latex cups, and coagulants. The quality of rubber is naturally lower than the estate product, but the bulk of smallholder rubber is sold at prices only 3 to 5 per cent lower than first grade estate smoked sheet.[5] The greater economy of resources, the low cost as well as the greater flexibility of production (that is the ability to stop tapping and turn to alternative occupations, without having to incur heavy overhead charges during periods of low prices) put the smallholders in a stronger competitive position than the estates. It is clear, therefore, that rubber is in many ways the ideal crop for a peasant economy.

The Problem of Low Yields in Smallholdings. In the past the smallholders were able to maintain their position in the Malayan rubber economy mainly through their ability to secure higher yields per acre than the estates. Yields in smallholdings, according to the 1931-32 survey, varied from a minimum of 485 lb. to a maximum of 513 lb. per acre per annum, the average was 477 lb.[6] Bauer's calculations gave average yields of 740 to 900 lb. per mature acre. In 1946

1. Meads, op. cit., Table XV, p.16, and p.42.
2. Ibid., pp.18-43, Tables XVIII, XXXI and XXXVI.
3. For an analysis of costs of production in estates, see Mudie and Others, op. cit., pp.74-7; and Bauer, op. cit., pp.57-8. For statistical data on costs of producing 1 lb. of rubber in 1947, see *Report of the Malayan Advisory Committee on Rubber Policy* (Kuala Lumpur, 1947), Table 1, pp.11-12.
4. Bauer, *The Rubber Industry*, pp.270-2.
5. Ibid., p.279.
6. Meads, op. cit., Table XXXI, p.36.

(July to September) the yields in smallholdings were equal to an annual production of 700 to 750 lb. per acre.[1]

Yields on smallholdings have fallen in recent years, not only in relation to their previous yields, but also in relation to estate yields, which in the pre-war period was from 6 to 31 per cent lower than in the smallholdings.[2] The position in estates and smallholdings in 1951 - 53 is shown in Table 41. The difference between the annual yields in smallholdings in 1941 and 1946 and those in 1951-53 varied from 400 to 500 lb. per acre. This is a very considerable difference, especially since the smallholder depends on a limited area for his livelihood, and cannot make up for low yields by increased output from a larger acreage. The 393.3 lb. per acre recorded for 1951 would appear to represent the maximum output in smallholdings as rubber prices in that year were at their highest since the war, and every effort was made to obtain the maximum production in order to take advantage of the high prices. Under more normal conditions, when prices were below $1 per lb., as for example in 1953, the yields in smallholdings were just over 300 lb. per acre.

TABLE 41: AVERAGE MONTHLY YIELDS OF RUBBER IN ESTATES AND SMALLHOLDINGS, MALAYA, 1951-53

	YIELD IN LB. PER ACRE					
	ESTATES			SMALLHOLDINGS		
	1951	1952	1953	1951	1952	1953
JANUARY	40·6	38·6	43·6	37·9	33·1	31·0
FEBRUARY	37·0	34·5	32·7	32·0	26·8	25·3
MARCH	42·8	36·8	37·4	39·9	29·0	22·3
APRIL	34·2	36·6	36·3	31·4	27·3	22·2
MAY	33·7	39·2	38·5	28·7	26·3	23·3
JUNE	39·7	39·0	37·7	34·9	29·2	22·5
JULY	38·1	42·1	41·8	30·1	28·4	26·9
AUGUST	38·2	40·3	40·8	34·9	30·9	28·4
SEPTEMBER	37·1	40·7	40·0	29·6	28·0	24·3
OCTOBER	39·1	41·2	41·7	32·1	28·4	25·3
NOVEMBER	37·9	41·7	40·2	29·2	28·4	25·4
DECEMBER	41·6	47·1	42·4	32·6	34·2	28·9
ANNUAL YIELD	460·0	467·8	473·1	393·3	350·0	305·8

Note: Average yields on estates are based on area actually tapped, but yields on smallholdings are based on total planted area. No information is available about the area being tapped on smallholdings.

Source: *Rubber Statistics Handbook, 1953*, Table 33, p. 105.

There are two main reasons for this decline in yield since the war. Firstly, the practice of dense planting has become less common. Even before the war smallholders were beginning to plant their trees further apart. This suggests that they were accepting the claims put forward by the estates that wider planting was more advantageous than close planting.[3] The second, and more important reason, is that a large percentage of the smallholding acreage has low yielding trees grown

1. Bauer, *The Rubber Industry*, pp.68-9.
2. Ibid, Table III, p.97.
3. Meads, op. cit., Table XI, p.12.

from ordinary unselected seedlings. In 1953, 92 per cent of the total smallholding area of 1,698,000 acres was of low yielding trees.[1] These trees, moreover, were approaching an age at which yields would, in any case, be decreasing. The problem of low yields in smallholdings came to the Government's attention in 1948, and an enquiry committee, known as The Rubber Smallholdings Enquiry Committee, was appointed to investigate the matter. Its first task was 'To report to what extent rubber trees on smallholdings have reached a condition or age when it is no longer economic to maintain them.' The interim report of the Committee concluded that 'the bulk of the smallholders' rubber trees are already obsolete or will shortly become so.'[2] The final report gave more precise figures on the age of the trees. Of a total smallholdings area of 1,402,000 acres under rubber in 1952, 937,000 acres (67 per cent) were over thirty years old, 338,000 acres (24 per cent) were between twenty and thirty years old, and 127,000 (9 per cent) were less than twenty years old.[3]

In 1954 the Mudie Mission of Enquiry published estimates of the age of smallholders' rubber trees, based on official data and recent surveys (Table 42). According to these estimates more than half the total acreage was over thirty years old, and four-fifths were over twenty-three years old at the end of 1953.

TABLE 42: AGE OF RUBBER TREES IN SMALLHOLDINGS IN MALAYA AT THE END OF 1953

AGE IN YEARS	PLANTED ACREAGE	PERCENTAGE OF TOTAL PLANTED ACREAGE
0-6 (IMMATURE)	120,000	7
7-11	26,000	2
12-22	192,000	11
23-27	240,000	14
28-32	320,000	19
33 OR MORE	800,000	47
TOTAL	1,698,000	100

Source: Mudie and Others, op. cit., App. C, p. 68.

The young[4] trees comprised only one-fifth of the total smallholdings acreage. The significance of these statistics becomes apparent when it is realized that the *Hevea* tree has a productive life of between thirty and forty years. Once the tree has passed that age, yields begin to fall rapidly. The actual yield per tree depends also on such factors as soil, root disease and its tapping history, but in general the correlation between age and yield is close, and tends to follow the pattern set out in Fig 29. The rubber tree is not tapped until it is about seven years old. The yield from the seventh year onwards increases rapidly until a peak is reached between the fifteenth and seventeenth year, after which there is a steady decline until the tree dies.[5] For this reason a rubber holding must be periodically renewed

1. Mudie and Others, op. cit., App. C, p.68.
2. *Interim Report of the Rubber Smallholdings Enquiry Committee* (Kuala Lumpur, 1952), p. B529.
3. *Final Report of the Rubber Smallholdings Enquiry Committee* (Kuala Lumpur, 1952), pp. B680-1.
4. Those less than twenty-two years old.
5. Mudie and Others, op. cit., p.11. Also *Interim Report of the Rubber Smallholdings Enquiry Committee*, p. B681.

by new planting, or by replanting, and the Mudie Mission recommended that this renewal should be done once every thirty years.[1]

Thus more than half of the smallholdings in 1953 was composed of over-aged trees, and another 30 per cent was due for replacement within a few years. Yields per acre, already low in 1951, will inevitably continue to decline each year, and it has been estimated that within ten years from 1954 they will fall a further 20 to 50 per cent.[2] The effects of this decline on the peasant's standard of living are evident, especially as his holding is small and he is highly dependent upon the income from rubber for his livelihood.

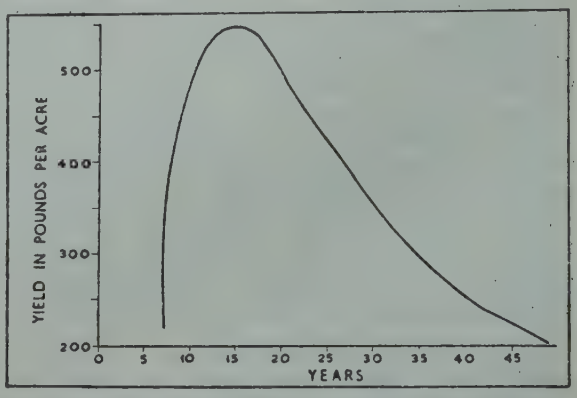

Fig. 29. Yield of the Rubber Tree According to Age.

The immediate problem facing most rubber growing peasants is to find a way of replacing their present stands, and increasing their output, for the only alternative to this is 'the virtual extinction of the smallholding industry as it is known today.'[3] As far as the technical means of increasing output are concerned the prospects are good, for new and improved planting material has now been developed which is capable of more than doubling the yields per acre. For instance, rubber clones tested and proved by the Rubber Research Institute have yielded from 1,200 to 1,500 lb. per acre per annum, as against the 400 to 700 lb. yielded by ordinary seedlings planted in peasant areas.[4] If therefore, the old low yielding trees could be replaced by new clones, the peasant would expect to obtain a far higher output from his holding, and a higher income per acre. There are two possible ways whereby the smallholders may replace their old trees: (1) by new planting; (2) by replanting.

(1) *New Planting.* Here the old stand is abandoned, and new land is planted with high yielding plants. There are several advantages in new planting. From the pedological standpoint it is preferable to replanting because the soil will be fresh and not partially or totally exhausted, as it would be where rubber has been growing for more than thirty years. The costs would also be less than in replanting since it is not necessary to manure the land and there is no lalang growth. New planting will be more desirable to the peasant, as he can still fall back on the income from his old stand while the new plants are maturing. The opening up of new land would also help to absorb part of the country's population increase.

1. Mudie and Others, op. cit., p.11. Also *Interim Report of the Rubber Smallholdings Enquiry Committee,* p. B681.
2. Mudie and Others, op. cit., p.24.
3. *Interim Report of the Rubber Smallholdings Enquiry Committee,* p. B681.
4. E.D.C. Baptist, 'Recent Progress in Malaya in the Breeding and Selection of Clones of *Hevea Brasiliensis*', *Report of the Thirteenth International Horiticultural Congress, Vol. II;* 1952 (England, 1953),. App. 2, p.1120; also *Annual Report of the R.R.I. of Malaya, 1952* (Kuala Lumpur, 1954), p.55; and Mudie and Others, op. cit., App. B., pp.66-7.

There are those who consider new planting to be detrimental to the national economy, because it means a further dependence on rubber in a country already over dependent upon this crop. Concurrent with this line of thought is the view that the alienation of land for rubber would mean a corresponding decrease in the area available for food-crops. But a counter argument would be that rubber is the only known and tested crop which can be planted on much of the undeveloped land of Malaya, and especially on hill slopes where food-crop cultivation would quickly lead to soil erosion.

It is also feared that because new planting entails migration to new locations it would cause unwanted social disruption. The Rubber Smallholding Enquiry Committee found that, although the demand for land was heavy, the smallholders were disinclined to move far away from their kampongs.[1]

Again, as the Malayan Rubber Advisory Committee pointed out, new planting on a large scale would involve considerable expenditure on roads, water supplies, medical and social services, and other facilities.[2]

Perhaps the strongest case against new planting is that the abandonment of the old holdings and the opening up of undeveloped land would represent a form of shifting cultivation. The length of time which abandoned land would take to regenerate to forest would depend on its cultivation history. In estates as a rule the more open aspect and the carefully controlled undergrowth would make for a longer period of regeneration, while in peasant holdings the uncontrolled undergrowth would allow for faster regeneration. In both cases, reversion to jungle is helped to a large extent by the fact that *Hevea,* being a tree, is easily absorbed as another forest species into the surrounding vegetation. But whether such a form of land-use is justifiable irrespective of the rate of regeneration is debatable. Arguments that more than three-quarters of the land in the Federation is still undeveloped, and therefore should be opened up for new rubber, miss the crucial point—that this move is tantamount to a policy of 'land-mining'.

Their great demand for land is proof that the peasants favour new planting. From 1922 to 1947 the policy of the Malayan Government was to restrict the alienation of land for rubber, the purpose of which, according to Bauer, was to sustain the high cost producers (that is, the estates).[3] The prohibition on new planting was repealed by the Federal Legislative Council in 1947, but the individual States continued to limit alienation of land for rubber.[4]

For several reasons the smallholders have been more affected by this restrictive policy than the estates. Most estates have land held in reserve which they could use for new planting even during a period when alienation of additional land is prohibited. In 1933 a Peninsula-wide survey showed that the estates held a total of 443,055 acres of land in reserve, or 14 per cent of the area already planted to rubber at that time.[5] Smallholders, and especially peasant holders, on the other hand, very seldom have any reserve land, and if they do it would usually be under other crops (such as fruit and coconuts), so that new rubber planting is either impossible or can only be done at the cost of destroying income-producing trees.

Because of the small size of each peasant holding, new planting, to be a practical proposition, must cover a substantial acreage (from 50 to 100 per cent)

1. *Final Report of the Rubber Smallholdings Enquiry Committee,* p.B683.
2. *Report of the Malayan Rubber Advisory Committee on Rubber Policy* (Kuala Lumpur, 1947), p.9.
3. Bauer, *Report on a Visit to the Rubber Growing Smallholdings in Malaya,* pp.13-40.
4. Mudie and Others, op. cit., p.33.
5. D.H. Grist, *Nationality of Ownership and Nature of Constitution of Rubber Estates in Malaya* (Kuala Lumpur, 1933), Tables 2, 13 and 19.

of the holding. It is impracticable for the peasant holder to plant a fractional acreage. For example, during the temporary lifting of the planting ban in 1939-40, the Government permitted each rubber grower to plant on new land up to 5 per cent of the planted acreage in 1938. While the owner of a 1,000 acre estate could plant fifty acres, the peasant with his three acre holding was entitled to plant only one-seventh of an acre, and since the majority of the peasants had no reserve land, planting could only be carried out on land some distance away. It was not surprising then that most of them preferred to sell their planting certificates rather than clear a fractional piece of land for new trees.

Since the war the demand for land by smallholders has continued to be very high, but it remains unsatisfied due to the States' reluctance to alienate land during the prevailing Emergency. Many settlers are also deterred by the high land alienation fees and yearly quit-rent which they have to pay, the latter of which they would have to continue paying for the seven years the rubber tree takes to mature. New planting is also being limited by the 'capacity of the Land Offices to deal with applications for land.'[1] The standard of land administration in Malaya has been criticised by the International Bank Mission as falling 'short of what is necessary in a matter of such fundamental importance.'[2] Many applications for land have been rejected by the Land Offices because of arrears of work on other land matters.[3]

For these reasons the total area of land newly planted with rubber by smallholders in the three years 1951 to 1953 was only 18,652 acres,[4] or 1.7 per cent of the smallholding acreage of trees which were over twenty-eight years old.[5]

(2) *Replanting.* It is clear that the replacement of old smallholdings by new planting has not proceeded very far. The other possibility is to replace them by replanting, that is by cutting down the old trees and planting new high yield seedlings in their place. Replanting is desirable on social grounds, in the case of a long settled community living in an area with no undeveloped land available for new planting, and unwilling to move to another region to take up new land. There are, however, several disadvantages in replanting an old stand of trees. There is the fact that the soil, after thirty years or more under rubber, is bound to have lost an appreciable portion of its natural fertility. The gently undulating land best suited for rubber is made up mainly of sandstones, quartzites and shales, the soils of which are amongst the poorest in Malaya. Manuring before replanting is the usual practice in estates, but the peasant cannot afford to do this.

Many rubber holdings, estates as well as smallholdings, were planted during the pre-depression days when the planting fever was at its height and no restrictions were imposed on land alienation. As a result many of them were established on partially exhausted soil previously cultivated under pepper or gambier, as in parts of Johore, or cloves and nutmegs, as in Penang, or coffee, as in Selangor. Others were developed on land too steep for successful growth of rubber and liable to

1. *Interim Report of the Rubber Smallholdings Enquiry Committee,* p. B683.
2. *The Economic Development of Malaya,* p.83.
3. Mudie and Others, op. cit., p.34.
4. *Annual Report of the Department of Agriculture, 1954,* p.67.
5. The Government of the newly independent Federation of Malaya has started a $3,000,000 scheme to open up 100,000 acres of new land for smallholders. Of this 75,000 acres will be for rubber cultivation and the remainder for other cash-crops. Each successful applicant will be given six acres for rubber planting and two acres for other cash-crops as well as a planting grant of $600. See *Singapore Standard,* 13th January, 1958.

excessive erosion, as in the hill-and-valley regions of Negri Sembilan, and the slopes on the higher flanks on both sides of the Main Range. Still others were on badly drained land liable to periodical flooding, which is especially inimical to good tree growth. Rubber trees on badly drained peat soils have their roots gradually exposed as the level of the peat layer sinks, and leaning or fallen trees are a common sight in peasant holdings in many parts of the country. To replant on these areas would be wasteful, but there is often no alternative open to the peasant, except to abandon rubber growing altogether as a means of livelihood. At the same time the official policy of sanctioning replanting, but discouraging new planting, means in effect that no newcomer desirous of growing rubber can do so because he cannot obtain the necessary land.

The small size of a peasant holding also militates against replanting. On an estate of 500 to 1,000 acres it is feasible to cut down, say, 3 per cent of the old trees each year, and so renew the entire stand every thirty-three years without a stop in production. On a peasant holding of four acres or so, replanting must be done over a much larger percentage area of land since to replant on a fraction of an acre is almost impossible as the seedlings would be unable to reach the sunlight, and they would have to compete against the surrounding trees for food.[1] But to uproot even an acre of land would mean a disruption of the tapping and rest cycle and a loss of a significant portion of the peasant's income. For these reasons replanting, though permitted and encouraged by the Government, was negligible until recently. Bauer estimated that only 25,000 acres, or 2 per cent of the total smallholding acreage, had been replanted by 1940, and these were mainly on medium rather than on peasant holdings.[2] After the Japanese occupation, and until 1950, a further 12,289 acres (0.88 per cent of the total smallholding acreage) were reported to have been replanted.[3]

The totally inadequate rate of replanting was the main factor responsible for the senescence of the majority of the smallholders' trees at the end of the war. Between the publishing of its Interim Report in 1950 and the issue of its Final Report two years later, the Rubber Smallholdings Enquiry Committee imposed a replanting cess on all rubber exported from Malaya. The funds accumulated from the cess were to be used in assisting replanting in both estates and smallholdings. The Rubber Industry (Replanting) Fund Ordinance was also passed in 1952. This Ordinance set up a statutory body—the Rubber Industry (Replanting) Board—to administer funds from the rubber cess, and to draw up schemes for replanting smallholdings. The estates' contribution to the cess is separate from that of the smallholdings. The smallholders' cess (4.5 cents per lb. of rubber exported) goes into a common fund, sometimes known as Fund B, from which allowances are paid to individual smallholders for approved replanting. The Fund is designed to finance the replanting of about 500,000 acres of the smallholding area by December 1959. The annual targets were 40,000 acres in 1953, 50,000 in 1954, 60,000 in 1955, 70,000 in 1956, 80,000 in 1957, and 90,000 in 1958 and again in 1959.[4]

The aim of the scheme is to assist the smallholder in replanting a part of his holding, without suffering too much from the loss of income during the period before his new trees reach tapping age. To this end it provides for a subsidy

1. *Interim Report of the Rubber Smallholdings Enquiry Committee,* pp. B530-1.
2. Bauer, *The Rubber Industry,* pp.185-6.
3. *Final Report of the Rubber Smallholdings Enquiry Committee,* p. B683.
4. Mudie and Others, op. cit., App. D, p.69, Note (3); and *The Economic Development of Malaya,* p.250.

of $400 (subsequently raised to $500[1]) per acre replanted, up to one-third of the holding for smallholders owning fifteen to ninety-nine acres, and up to five acres for a peasant owning less than fifteen acres. The scheme also provides for the provision of high yielding planting material,[2] the distribution of fertilisers, and in some cases the poisoning of the old trees. The money grant is paid to the smallholder in instalments as the work of clearing and replanting progresses. The total cost of replanting an acre in 1952 was estimated at $600.[3] In 1955 the cost was between $600 and $700.[4]

The progress of the scheme since its inception has been very slow. In 1953 only 20,000 acres (as compared with the target of 40,000), and in 1954 only 33,000 acres (target 50,000) were replanted. Of the total 53,000 acres, 49,701 were replanted with high yielding rubber, and 3,461 acres were replanted with crops other than rubber—1,010 acres with fruit, 865.5 with coconuts, 878 with coffee, 545 with padi, 161 with pineapples and 2 acres with sago.[5]

The total smallholding area replanted between 1947 and 1954 was 73,317 acres. This figure is very small compared with the 346,229 acres replanted by estates over the same period.[6] That the peasants as a group have not benefited from the scheme to the extent visualized is indicated by the fact that applications for replanting grants have come more from those with the larger size of holding. Thus within the smallholdings category, the owners of the medium holdings (25 to 99 acres) have been the main beneficiaries, whilst the peasants who own the larger share of the smallholding acreage have benefited least, although both contribute to the replanting cess at the same rate.

A number of factors were responsible for this lack of headway in the peasant holding replanting programme. There was the difficulty of making the peasant understand the ultimate advantages of replanting, and the consequences of not doing so. The publicity given to the scheme was often distorted in the process of its filtering down to the peasant. For example, many peasants did not realize that the replanting grant of $500 per acre was a free grant and not a loan, and in parts of Kedah the idea was extant that these loans were given on condition that the Government was to control the eventual tapping and sale of the replanted rubber.[7] Again, when making out his application for permission to replant, the peasant had to submit technical information about his holding in writing, a procedure little understood by those who were illiterate.

The process of replanting was seriously delayed in a number of instances by the rapid spread of lalang (*Imperata* spp.) over the cleared land. This weed checked the growth of the young trees. Control of the weed, to be effective, must be complete. The only cheap method of eradicating it was through poisoning by spraying sodium arsenite, but the dangers from accidental poisoning of people and cattle were too great to permit its general use. It was estimated that widespread lalang infestation would increase the labour task for the first eighteen months

1. The *Straits Echo,* 30th November, 1955.
2. The Government nurseries were extended to provide for improved planting material for 80,000 acres a year. M.V. del Tufo, 'Rural Development in Malaya', *Programmes and Plans for Rural Development in Tropical and Sub-tropical Countries* (Bruxelles, 1953), p.254.
3. *Final Report of the Rubber Smallholdings Enquiry Committee,* p. B682.
4. The *Straits Times,* 22nd April, 1955.
5. *Annual Report of the Department of Agriculture,* 1954, p.6.
6. *The Economist,* 9th October, 1954, p.146.
7. *The Straits Echo,* 30th October, 1954.

of replanting by 60 to 100 days.[1] The labour necessary to clear even an acre of old rubber was also heavy, involving two months of work with the axe.[2]

The main reason for the slow rate of replanting in the smallholdings was the peasants' reluctance to cut down their trees, and lose their major source of income for the six or seven years before the new trees matured. The Mudie Mission estimated that, with a rubber price of 70 cents per lb., and with a replanting grant of $400, the peasant's net loss per replanted acre over seven years would be about $650, after deducting the saving in labour cost through the non-tapping of the replanted area during that period.[3] Even with the grant raised to $500, the net loss would still be sufficiently great to make the peasant hesitate before deciding to replant.

When it was decided to raise the grant from $400 to $500 a Government report pointed out that this increase would reduce the existing Smallholder Replanting Fund to an amount a little short of that necessary to finance the 500,000 acre target set for 1959, and it recommended that the Government should provide financial aid in order to ensure more rapid progress.[4]

Towards the end of 1955 it was decided to raise the grant still further—to $600 per acre—in order to encourage the peasants to replant.[5]

The difficulty of inducing peasants to replant becomes greater as the price of rubber increases, and it was discovered that the high prices prevailing during the latter part of 1955 (over $1 per lb.) made many peasant owners, whose applications had already been approved, delay cutting down the trees in order to take advantage of the rise in price.

The complexity and size of the administrative machinery needed to deal with applications, and, after approval, to ensure that each stage of replanting is carried out according to the required standard, imposes a heavy strain on the office staff and on available funds. The recurrent costs of administration for the replanting of 50,000 acres in 1954 were estimated at over $12 per acre replanted, and both the volume of work and the costs were expected to increase to much higher levels in subsequent years.[6]

Falling yields from old and over-age trees have put the peasant in a precarious position in the Malayan rubber industry. The attempt to ameliorate the situation through the Replanting Scheme has so far only scratched the surface of the problem, and unless there is a significant improvement in the rate and extent of replanting of smallholder rubber within the next decade or so, there will inevitably be a rapid deterioration of the peasants' economic status and level of living. The replanting target of 500,000 acres by 1959 is not likely to be reached.[7] In the meantime the gap between the area of land with over-aged trees and the area of newly planted land grows wider every year.

PROBLEMS OF CROP SPECIALIZATION

The growing of revenue crops by large numbers of peasants is as much a characteristic of the present century as the plantation system was of the earlier

1. Mudie and Others, op. cit., App. E, p.72.
2. It was announced in 1954 that a new chemical (245T) had been discovered which would reduce the felling work to four hours instead of two months. The chemical would also stimulate the yield of latex from the tree before killing it within three or four weeks. *Malayan Bulletin,* Vol. VIII, No. 94, 1954, p.4 and Vol. IX, No. 97, 1955, p.4.
3. Mudie and Others, op. cit., App. E, pp.70-6.
4. *Taxation and Replanting in the Rubber Industry* (Kuala Lumpur, 1955), pp.17-18.
5. The *Straits Times,* 4th November, 1955.
6. Mudie and Others, op. cit., pp.28-9.
7. The *Singapore Standard,* 4th October, 1955.

centuries. Peasant participation in the western economy represents the extreme form of departure from the customary subsistence economy. It leads to high material living standards by means of increased production, and increased earnings. The tendency is to move more and more towards crop specialization, and towards the cultivation of a cash-crop as a sole occupation rather than as one in a variety of other occupations.

The botanic nature of the plants grown has an important influence in determining the relative extent to which specialization can be carried. Perennial tree crops provide a greater degree of permanence of cultivation than annuals, because the trees take a longer time to reach maturity and have a longer productive life. The productive life of a rubber tree may be over thirty years while that of a coconut tree may be up to a hundred years. Annual crops on the other hand, are short termed and their cultivation is based on a yearly rather than a multiple year cycle. Specialization where tree crops are concerned therefore becomes more complete. The decision to plant revenue tree crops must be a long term one as the trees will be more or less a permanent fixture on the land for some time. In order that they may yield a reasonable income, a substantial portion of the small area of land at the peasant's disposal may have to be turned over for the purpose, so that both factors work to lock up a large part, if not the whole, of the land for a considerable period of time. At the same time the area of land devoted to, say, rubber in Malaya and cocoa in the Gold Coast will tend to increase, or at least remain static, over the years until the trees become old and cease to be economic. On the other hand the area under annual crops is liable to fluctuate from one year to the next depending upon external factors such as prices, and upon internal factors such as soil conditions, or on other considerations which may influence the individual peasant's decision one way or the other as to whether he should plant more or less of the crops the following season.

Crop specialization everywhere exposes both peasants and plantations to the dangers of plant disease. The concentration of one species of plant over large contiguous areas means also a concentration of food for the plant parasite population, so that there may be a rapid multiplication of the parasites and the possibility of epidemic outbreaks of disease. The danger has long been recognized, but it has become more serious in recent years. The development of modern and rapid forms of transport makes it possible now for infected material, and parasites, to be carried over long distances, and be introduced in an area hitherto free from a particular disease.

The small size of the average holding and the smallholder's lack of money and means make the control of serious plant diseases in peasant areas very difficult. Control measures must be cheap, effective and of easy application to suit peasant conditions. The Panama disease of the banana plant, which has spread throughout the Caribbean region, is caused by an organism which lives in the soil, and so far no economic means of control has been found. The banana 'Leaf Spot' disease can only be destroyed by frequent spraying of the leaves, but this method has been found to be too expensive for the peasants, and they have had to abandon some of their plots instead.[1] The 'Swollen Shoot' disease of cocoa in West Africa has caused widespread damage to cocoa, and economic distress to the peasant farmers, as its diffusion could only be checked by cutting down and burning the infected trees, which is an expensive process.[2]

1. W. Popenoe, 'The Development of Tropical American Pomelogy', *Report of the Thirteenth International Horticultural Congress, Vol. II, 1952* (Kent, 1953), p.1211.
2. A.F. Posnette, 'Virus Diseases of Cocoa in West Africa: the Present Position', ibid., pp.1224-30.

Rubber planters in South-east Asia have not yet met with a disease capable of doing damage on the scale of, say, the 'Swollen Shoot' disease in Africa, although there are various known endemic diseases attacking the roots, trunk, bark, and leaves of the rubber tree and doing considerable damage.[1] The equatorial conditions under which *Hevea* is grown favour the spread of fungi infections such as 'Black Stripe' and 'Mouldy Rot'.[2] But the gravest potential threat comes from the fungus *Dothidella ulei* which causes the disease known as the 'South American Leaf Blight'. Leaf Blight is capable of doing very extensive damage to the rubber tree, and the similarity of environmental conditions between the Malay Peninsula and the Amazon Basin, where the Blight is indigenous, emphasizes its seriousness as a potential source of danger to planters in the Peninsula and other parts of South-east Asia.[3] This danger has been recognized, and an agreement for preventing the introduction of Leaf Blight into South-east Asia and the Pacific Region was made at the Phyto-Sanitary Conference, held in Singapore under the auspices of the Food and Agriculture Organization in 1949.[4]

Too great a dependence upon one crop means a corresponding sensitivity to the prices for that crop, and where, as amongst the large proportion of the rubber growing peasants of Malaya, the proceeds from the sale of the crop are the main means whereby imported food can be purchased for everyday living, this specialization can lead to serious consequences during periods of low prices. Producing for the raw materials market is always a speculative venture, but the peasant cannot afford to gamble with his food supply. In seeking the advantages of specialization, he has also to cope with its attendant liabilities. That these prices can oscillate enormously is illustrated in Fig. 30.[5] Between the price of 7 cents per lb. of rubber as obtained in the Malayan market in 1932, and the 169 cents per lb. in 1951 is a difference of 2,400 per cent. The prices as shown in Fig. 30 represent the annual average only, the degree of fluctuation for monthly prices would be even greater. The standard of living of the Malayan rubber growing peasant, as represented by the prices he received for his crop, has thus

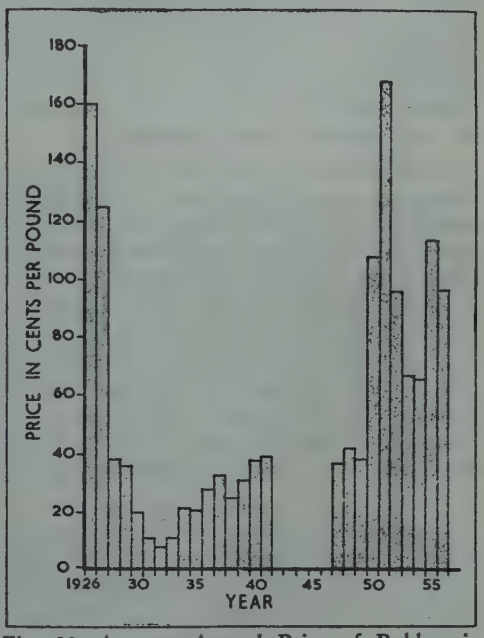

Fig. 30. Average Annual Price of Rubber in Malaya.

1. For descriptive accounts of these diseases, see Edgar op. cit., pp.122-68.
2. A. Sharples and Others, *Black Stripe and Mouldy Rot of Hevea Brasiliensis* (Kuala Lumpur, 1920).
3. R.H. Hilton, 'South American Leaf Blight', *Journal of the R.R.I., Malaya,* Vol. XIV, 1955, pp.287-354.
4. *Report of the Phyto-Sanitary Conference held at Singapore from April 26th to 28th, 1949,* Items No. 12 and 13.
5. An analysis by the United Nations Department of Economic Affairs reveals that during the fifty years from 1901 to 1950, the prices of twenty-five primary commodities, representing the major exports of selected underdeveloped countries, fluctuated by an average of 14 per cent each year. See U.N. *Instability in Export Markets of Underdeveloped Countries* (New York, 1952), pp.3-4 and Table 1, p.4.

varied from the margin of subsistence between 1930 and 1940 to the height of affluence during the 1951-52 rubber boom, when he could afford to buy such luxury goods as wireless sets, sewing machines, motor-cars, and all manner of other expensive articles.[1] But it is doubtful if there has been a real increase in peasant living standards, even during the boom, because of inflation and because much of the money realized was quickly used in a spate of extravagant spending. The solution to this particular problem of extravagance is a sociological rather than an economic one, and it implies a change in attitudes, and the correction of certain tendencies. But on the economic front, there has been no attempt by the Malayan Government to reduce, on the lines of the Produce Marketing Boards in Africa, the shocks arising from price variations.

The rubber planter in Malaya, as elsewhere, is now faced with competition from the synthetic product.[2] From an insignificant start before the war, synthetic rubber has grown to occupy a major place in the world markets. In 1953 the output of synthetic rubber of 840,000 tons was 33 per cent of the world output of all types of rubber.[3] Forecasts of the future of the Malayan rubber industry, in the face of the threat from synthetic rubber, have varied in tone from the optimism and confidence shown by the Malayan Rubber Advisory Committee on Rubber Policy, to the cautious optimism shown by both the Mudie Mission and the International Bank Mission.

A recent analysis of the sterling dollar trade with America has shown that American demand for the five traditional dollar-earners (wood, rubber, tin, cocoa, and jute) might 'dwindle rather than expand as the years go by', a pronouncement which, if borne out, would have an adverse effect on the natural rubber industry.[4] The denationalization of the United States' synthetic rubber factories in 1955 was expected, by the natural rubber producers, to lead to a greater demand for natural rubber in America, as it was thought that synthetics could only be manufactured at high cost and must therefore be sold at high prices. When denationalization took place, there was a slight increase in demand for natural rubber, but it lasted for only the few months. The output for 1955 was expected to rise to 42 per cent above the 1954 level, while the expected increase in selling price did not occur because of advances in manufacturing techniques which lowered costs.[5]

The last advantage of natural rubber over synthetic disappeared with the discovery of an exact synthetic duplicate of the natural product. The general expectation in rubber circles is that there will be a steady drop in price because of the competition from synthetic rubber, and of the low costs with which it is manufactured.[6] In Malaya, neither the peasant nor the country as a whole can afford to have a recurrence of the widespread unemployment of the nineteen-thirties, which resulted from the drastic fall in the price of rubber. Not only will the economic structure be affected, but the social and agrarian unrest that may follow would have widespread repercussions.

The weakness of the country's economic foundation in relying on one crop was realized by the Malayan Government as early as 1920, when the first rubber

1. These were subsequently sold or pawned at great loss when the boom ended and prices fell again.
2. Competition from synthetics is not confined to rubber but extends along the range of tropical products. See H.N. Blommendaal, 'Chemistry Threatens Tropical Products', *Tropical Agriculture,* Vol. XVI, No. 10, 1939, pp.221-3.
3. Mudie and Others, op. cit., p.5.
4. J. Benz and C. Furlong, 'New Trends in the Sterling Dollar Trade', *Progress,* Vol. XLIV, No. 245, 1954-55, pp.134-9.
5. *The Times* (*Annual Financial and Commercial Review*), 24th October, 1955.
6. Mudie and Others, op. cit., pp.1-3, 51.

slump occurred, but any embryonic idea of correcting it was forgotten in the prosperity which soon followed and continued until 1929. The Great Depression brought with it the first step towards developing a less vulnerable national economy. But the new agrarian policy of diversifying commercial agriculture, which was first suggested by Sir Frank Stockdale in 1938, was adopted too late (because of the war) to be effective.[1] The post-war official agricultural policy has as one of its main aims the diversification of the agricultural economy of Malaya.

PROBLEMS OF CROP DIVERSIFICATION

Diversification presents many problems. The crops must firstly be suited to the equatorial environment, that is, they must be capable of giving sustained yields over a period of time without straining the fertility of the soil. In Malaya the best possibilities are tree rather than annual crops. But planters would have to face competition from other tropical areas growing the same crops. Such areas might have advantages derived from an early start, from some particularly favourable physical factor of soil or climate, or from proximity to markets. Most of the known tropical crops are already grown in quantities in one tropical country or another, and any attempt to compete with a rival territory implies a capacity to produce the same crop cheaper and better, granting that the market for the commodity is not already saturated.

For the peasant smallholder the problems are more difficult to solve because of his lack of capital and technical equipment, which limits the range of possible crops to those which do not require an initial heavy capital outlay, or elaborate equipment for crop processing. Again, the small size of each holding, the different cultivation and processing techniques, and transport and marketing difficulties may prevent the peasant from planting more than one type of revenue crop on his land. Although the original Malay holding is typified by a large variety of crops, yields are usually low and the products are of a quality insufficient to command any but the lowest prices in the market. As Sir Frank Stockdale has said, 'The attractiveness of different crops cannot always be judged by the same measures as are applied in estate production, and a peasant's views are apt to vary with his personal circumstances and the size of his holdings.'[2]

The modern demands for high quality and standardization are best served by some degree of specialization. Hence the need for diversification applies not to conditions within each peasant holding but within the country as a whole. The ideal agricultural economy may be visualized as one in which the agrarian population is composed of crop specialists who do not all plant the same crop, but rather a number of equally important cash-crops.

The present structure of agriculture in Malaya is shown in Table 43. The overwhelming importance of rubber emphasizes the lop-sided character of the Malayan agricultural economy. The other commercial crops of importance are coconut, oil-palm, and pineapple, of which oil-palm is exclusively an estate interest.

Perhaps the most significant factor in the present position of agriculture in Malaya is that, except for rubber, padi and oil-palm, the acreages of the other crops are smaller than in 1940,[3] 'indicating an absence of strong spontaneous growth factors among most of Malaya's minor crops.'[4] In brief, none of the

1. Sir Frank Stockdale, *Report on a Visit to Malaya, Java, Sumatra, and Ceylon, 1938*, passim.
2. Ibid., pp.56-7.
3. *Annual Report of the Department of Agriculture, 1948*, p.79.
4. *The Economic Development of Malaya*, p.60.

minor cash-crops that have been experimented with in the past, or those that are still being grown today, have had the same attraction for the peasant as rubber. The most promising approach to diversification of peasant cash-crop agriculture appears to be in the direction of new and untried crops, which could satisfy the different requirements implied in peasant cultivation. There are two such crops which offer distinct possibilities for peasant cultivation.

TABLE 43: COMPARATIVE ACREAGES OF AGRICULTURAL CROPS IN MALAYA, 1953

CROPS	ACREAGE	PERCENTAGE OF TOTAL ACREAGE
RUBBER	3,727,500	67·1
PADI	834,000	15·0
COCONUT	512,700	9·2
FRUITS	173,600	3·1
OIL-PALM	108,300	1·9
FOOD-CROPS (a)	82,100	1·5
SPICES	55,600	1·0
MISCELLANEOUS (b)	65,300	1·2
TOTAL	5,559,100	100·0

(a) Including tapioca, sweet potatoes, sago, sugar cane, groundnuts, maize, yams and vegetables.
(b) Including derris, ramie, manila hemp, nipah, gambier, kapok, coffee, cinchona, citronella, tung-oil, gutta percha and tobacco.

Source: *Annual Report of the Department of Agriculture, 1954,* App. I, p. 82.

(1) Oil-palm. This crop has always been an estate monopoly since its introduction into Malaya in 1917.[1] The oil-palm is the least soil-destructive of all cash-crops, but it requires 312 lb. of mineral food per acre per annum as compared with 53 lb. for rubber.[2] The Malayan climate is highly favourable to good palm growth.[3] The palm flourishes on a wide range of soils, provided there is good drainage, but it grows badly on peat land, on soils with impervious hardpan layers, on very sandy areas, and on black soils with a high percentage of carbonaceous matter.[4] Yields, even from unselected seedlings, are high, and other factors in its favour are the long productive life (the tree bearing harvestable fruit from its fourth to its thirtieth year), and even fruiting throughout the year.[5] Harvesting is done at intervals of seven to eight days, but shorter intervals between harvests is possible, so that the rhythm of work would not be very different from the tapping cycle in a rubber smallholding.

Several factors have contributed to keeping oil-palm cultivation an estate monopoly. Although the palm was first planted in Malaya in 1917, it was not until 1926 that its cultivation was taken up seriously. The planted area then increased from 12,098 acres in 1926 to 63,646 acres in 1933. The main areas were in Johore, Perak and Selangor, and a few scattered places in Negri Sembilan,

1. For an account of the early history of oil-palm in Malaya, see R.B. Jagoe, ' "Deli" Oil-Palms and Early Introduction of *Elaeis guineensis* to Malaya', *M.A.J.,* Vol. XXXV, No. 1, 1952, pp.3-10.
2. Gourou, op. cit., p.139.
3. R.B. Jagoe, 'Notes on the Oil-Palm in Malaya', M.*A.J.,* Vol. XXII, No. 11, 1934, p.541.
4. Grist, *An Outline of Malayan Agriculture,* p.135.
5. *Annual Report of the Department of Agriculture, 1950 and 1951,* p.8.

Pahang and Kelantan.[1] But by 1926 rubber had already firmly established itself as the dominant crop for both estates and smallholdings, and none of the peasant farmers were interested in oil-palm. The machinery for extracting the oil from the fruit was expensive and the processes involved were complicated. It was estimated that the fruit from 2,000 acres of palm were needed to keep one factory going. Further economies of large scale production were realized by shipping the oil in bulk instead of in barrels, and by careful processing to produce a high quality oil with a low free fatty-acid content (2 to 3 per cent as compared with 18 per cent for West African oil).[2] All these called for a large labour force, heavy equipment, a good network of roads and railways, and for heavy capital investment, none of which was within the capacity of the peasant to provide.

The idea soon grew that oil-palm could only be grown successfully by estates, and as early as 1934 the Government had given its official confirmation to this notion by stating that an area of at least 200 acres must be taken up by any person desiring to alienate land for oil-palm cultivation.[3]

That oil-palm can be grown by peasants is shown in West Africa where the bulk of the oil comes from peasant holdings, though admittedly the quality and the price of their product are lower than those of the carefully prepared oil from Malayan estates.[4] The main obstacle to peasant cultivation is the expensive machinery needed for extracting the oil. But it has already been found that a small hand-press, as used in Nigeria, could be adapted to meet the needs of an area of about twenty acres, the press being capable of processing an oil equal in quality to the estate oil, but having a recovery rate of 70 per cent as against the 90 per cent of the estates.[5] The Director of Agriculture has expressed the opinion that prospects of oil-palm cultivation by smallholders are good, once transport, oil-extraction and marketing are efficiently organized.[6] The International Bank Mission has recommended the establishment of a carefully planned pilot scheme to cover both the production and processing aspects of the industry, as well as the special study of all the other problems connected with peasant oil-palm cultivation.[7]

(2) Cocoa. The second crop which offers a likely avenue for the diversification of peasant cash-crop agriculture is cocoa. There are isolated cocoa trees throughout Malaya but the crop has never been grown on a commercial scale. After the war, considerable interest was aroused in Malaya by the potentialities of cocoa as an alternative to rubber, partly because of the greater world demand, and partly because of the decreased production in West Africa and the West Indies due to the 'Swollen Shoot' disease. At the end of 1947, the Colonial Office investigated the possibilities of cocoa cultivation in Malaya, Sarawak and North Borneo. It reported that Malaya was capable of producing 100,000 tons of cocoa per annum and that the development of a cocoa industry was not likely to

1. 'Agricultural Research in Malaya', *British Malaya,* Vol. II, No. 5, 1927, p.133; and 'Report of the Vegetable Oil Committee on the Present Economic Condition of the Coconut and other Oil-Producing Industries', *M.A.J.,* Vol. XXII, No. 9, 1934, pp.405-35.
2. *British Malaya,* Vol. III, No. 2, 1928, pp.55-6.
3. Report of the Vegetable Oil Committee on the Present Economic Condition of the Coconut and other Oil-Producing Industries', *M.A.J.,* Vol. XXII, No. 9, 1934, pp.405-35.
4. Prices for West African palm-oil are being forced down because of competition from the more efficient estates in Tropical Asia, and also because of competition from whale and other oils in world markets. See H.C. Sampson and E.M. Crowther, 'Report on Crop Production and Soil Fertility Problems', *The West Africa Commission, 1938-39, Technical Reports* (London, 1943) pp.29-30.
5. J.N. Milsum and C.D.V. Georgi, 'Small Scale Extraction of Palm Oil', *M.A.J.,* Vol. XXVI, No. 2, 1938, pp.53-8.
6. *Annual Report of the Department of Agriculture, 1950 and 1951* p.8.
7. *The Economic Development of Malaya,* pp.259-60.

interfere with either padi or rubber cultivation as the requirements of the tree were different from those of the other two crops. Malaya also has the advantage of being free from the major cocoa diseases. The best soils for cocoa are those derived from igneous rocks, particularly from the Pahang Volcanic Series, these soils are limited in area and are distributed mainly in eastern Malaya (Fig. 21). The lower and gentler slopes of a hill-and-valley region offer the best conditions for the growth of the cocoa tree. Because of its more exacting soil and shade requirements, cocoa cannot be grown on land already planted to rubber, so that the likelihood of its replacing old and less profitable rubber areas can be discounted. Neither can it be successfully interplanted with rubber. The area of land in Malaya which can fulfil the requirements of the cocoa tree is estimated at a quarter of a million acres.[1]

The Department of Agriculture has been accumulating supplies of planting material and gathering information on the behaviour of the cocoa tree under Malayan conditions. In 1949 trial blocks of seedlings imported from Ceylon and the Gold Coast were made, and experiments on locally available material were also conducted.[2] It was subsequently decided that importation of seed or budwood should be stopped, because of the dangers of introducing virus diseases into the country. Multiplication of the material already imported becomes the only method of increasing supplies of seedlings. Agricultural experiments have shown that the tree thrives under jungle or semi-jungle conditions, but will not do well when inter-cultivated with rubber or planted on the poorer soils.[3] The variety of cocoa imported from the Gold Coast, known as the *Amelonado,* has proved the most promising in Malaya, being more vigorous, and of better height and girth than the local *Trinitario* strain. The *Amelonado's* pods also contain beans of a size acceptable commercially.[4]

The results up to 1954 were so promising that the Federal Government voted a sum of $300,000 for 1955 and 1956 for further research on the potentialities of the crop.[5] Plans have been drawn up to reserve 15,000 acres of land in Pahang for the cultivation of the crop. It is believed that a total of 100,000 acres of suitable land is available for future development.[6]

Cocoa is promising as a peasant crop. The kampong or mixed garden environment is well suited to the tree. Because of the need for processing and fermentation of the beans, a minimum of two to three acres must be planted, as otherwise the number of beans would be insufficient for proper fermentation. The techniques of cultivation and processing are at present unfamiliar to peasants in Malaya. The requirements of the tree which prevent its growth on old rubber areas and the lack of reserve land, however, render the establishment of the crop on existing peasant holdings unlikely, and any development must therefore be confined to new lands. The best argument for cocoa cultivation by peasant farmers is that the bulk of the cocoa in West Africa is produced successfully by peasants. But so far only the estates in Malaya have shown interest in growing the crop.

1. E.E. Cheesman, *Report on Potentialities for the Cultivation of Cocoa in Malaya, Sarawak, and North Borneo* (London, 1948), pp.2-14.
2. C.W.S. Hartley, 'Investigations into the growing of Cocoa in Malaya', *M.A.J.,* Vol. XXXII, No. 1, 1949, pp.59-69.
3. E.F. Allen, 'Investigations into the Cultivation of Cocoa in Malaya', *M.A.J.,* Vol. XXXVI, No. 3, 1953, pp.147-63.
4. E.A. Rosenquist, 'Amelonado Cocoa in Malaya', *M.A.J.,* Vol. XXXVI, No. 3, 1953, pp.164-80; also *The Economic Development of Malaya,* pp.262-3.
5. *Malayan Bulletin,* Vol. VIII, No. 87, 1954, para. 146.
6. The *Straits Times,* 5th August, 1955.

Malayan Cocoa Limited has been conducting experiments in Kuala Trengganu since 1951. The United Cocoa Development Company plans to cultivate an area of 1,000 acres and start commercial production in five years from 1955. The International Bank Mission has recommended that a pilot scheme should be started through which smallholders could be introduced to the possibilities of cocoa as a cash-crop. This recommendation has been endorsed by a Government Cocoa Working Party.[1]

The diversification of peasant revenue-crop agriculture can only be achieved over a long period of time. Cocoa is still in the experimental stage, and both cocoa and oil-palm are trees which take some years to mature. Apart from this, great difficulties are likely to be encountered in trying to induce the peasant farmers to grow crops which are outside their agricultural experience, and which also demand fairly elaborate processing before sale. The decision to plant must be a long-term one, for both cocoa and oil-palm have long productive lives. There is also no guarantee that the prices for either crop will not fall as drastically as those of rubber have done in the past. Diversification is therefore a means of protecting the regional economy but not the individual farmer.

Where the peasant has his holding entirely under a money-crop, and has no alternative means of subsistence open to him, he is compelled to sell his crop whatever the market price may be. In Malaya the closed subsistence economy no longer exists, for even the padi-planter depends to some extent on the sale of part of his produce to meet his cash needs. The tendency for peasants to turn from the subsistence economy to participate in the monetary economy is well marked, and will be expected to develop further in the future.[2] The material standards of living will then more nearly coincide with the levels of the money income, and will consequently be extremely sensitive to fluctuations in crop prices.

While it is inevitable that during the transitional period, from a subsistence to a monetary economy, there must be some dislocation and friction it may be questioned, on the other hand, how far the standards of living of the peasants can be allowed to vary with changes in the prices of unstable commodities such as rubber. So far the Government of Malaya has confined its activities mainly to the technical aspects of increasing production in cash-crop agriculture, but it is discouraging to the peasant to find that all the efforts of the Government to help him increase his production are, in the end, unavailing because the more he produces the less money he seems to get for his crops because prices have fallen. In West Africa, the Produce Marketing Boards have helped considerably in ironing out the ups and downs of commodity prices, and in reducing the undesirable effects of booms and slumps on the peasant smallholder. The Cocoa Marketing Board in the Gold Coast, for example, was set up in 1947 for this purpose. The price for the season is fixed by the Board and the peasants are then assured that their crop will be taken up by the Board no matter what the world prices may be. Thus though the world price for cocoa fell by 50 per cent during 1955—from £500 to £250 a ton—the West African peasants were unaffected, because the

1. *Report of the Working Party set up to consider the Development of a Cocoa Industry in the Federation of Malaya* (Kuala Lumpur, 1955).
2. This refers particularly to the Malays. The Chinese and Indians are already well within the monetary economy, participating in all aspects of the production, trade and commerce of the country.

guaranteed internal prices paid by the Marketing Boards remained the same.[1] In this respect Malaya, with its peasant rubber industry as important to the country's economy as the peasant cocoa and oil-palm industries are to the economies of West Africa, has lagged behind, and it may be argued that it is the responsibility of the Government to provide for such an adjustment to the secular trend of prices and hence help to stabilize standards of living.

1. *The Times Annual Financial and Commercial Review,* 24th October, 1955. For more details of the West African Marketing Boards, see C. Leubusher, 'Marketing Schemes for Native-Grown Produce in African Territories', *Africa,* Vol. XII, No. 2, 1939, pp.163-87; also *A Review of Colonial Marketing Organisations and Related Bodies* (London, 1952); and D.M. Williams, 'West African Marketing Boards', *African Affairs,* Vol. LII, No. 206, 1953, pp.45-54.

CHAPTER VII

SOCIAL AND ECONOMIC PROBLEMS OF PEASANT PRODUCTION FOR THE MARKET

THE PROBLEM IN ITS SOCIAL SETTING.

A SUBSISTENCE economy is characterised by production to meet the limited needs of the community, and there is neither the incentive nor the means for the production of regular surpluses. This is one intrinsic aspect—the economic aspect—of a society which, being firmly surrounded by barriers (cultural as well as economic), has been rightly described as a 'closed society'. In the Malay Peninsula, and other parts of South-east Asia in the past, the centre of community life was the village, which has been defined by Boeke as '...a religious community of food-crop cultivators, all or not belonging to the same clan, and ruled by a common tradition.'[1] Its coherence was derived from its social unity. Within the communal unit each man had a fixed place in life around which his culture was integrated and his wants satisfied. The pattern of life was a pre-established order, and the aim of life was the maintenance of that order.

The village was composed of a number of independent family units, each producing enough to satisfy its own needs. The size of the village was determined largely by the fertility of the soil. The more fertile the soil, the larger the number of family units that could draw sustenance from it, and hence the bigger the village, and vice versa.[2] When the pressure of population on the land became acute, a local migration of the surplus people took place, usually to another piece of land near the original village, so that the villages propagated themselves in a manner reminiscent of living organisms. The original village was called the 'desa' and the offshoot the 'dukoh'. In time the 'dukoh' would grow into a 'desa'. This manner of population diffusion was common among the Malays in many parts of the Archipelago.[3] Each 'desa' would include up to twenty houses with a population of from 40 to 200. Lowland Malaya about 1750 was colonised in a like manner by petty, isolated Malay communities clustered round riverine locations.[4] Economic specialisation was little developed. Technology was of the simplest kind. A local artisan could seldom expect to live by his art alone in a small community where there was not enough custom to support him. He had also to be a farmer or fisherman like his neighbours.[5] Thus every person was in turn a farmer, fisherman, labourer, or a collector of produce. In Negri Sembilan, for example, only the local chieftains had a special role as entrepreneurs, as owners of small estates, traders, organisers of mines and recipients of royalties

1. J.H. Boeke, *Economics and Economic Policy of Dual Societies as Exemplified by Indonesia* (New York, 1953), p.27.
2. Ibid., pp.24-70. The village might often be comprised of a single large family. See J.S. Furnivall, 'The Political Economy of the Tropical Far East', *Jrn. Roy. Central Asian Soc.*, Vol. XXIX, 1942, p.196.
3. G.A. Wilken, 'Essays on Kinship and the Laws of Marriage among Malayan Peoples and on Matriarchy in Sumatra', *Papers on Malay Subjects* (Kuala Lumpur, 1921), No. 5, pp.7-8.
4. Sir George Maxwell, 'The Administration of Malaya', *British Malaya,* Vol. XVII, No. 12, 1943, p.139.
5. R.J. Wilkinson, 'Life and Customs, Pt. I. The Incidents of Malay Life', *Papers on Malay Subjects* (Kuala Lumpur, 1908), p.12.

from land and mines.[1] Subsistence labour was unspecialised, and there was no subdivision on the familiar western pattern of capitalist rentier, organiser of production, and labourer or worker, for in practice one set of persons often fulfilled all three functions.[2]

The strong ties that bound a village together also caused the community as a whole to care for its unemployed, orphans, aged and sick, and no unemployment problem existed.[3] Production did not go far beyond that needed to supply the necesessities of the community. One of the main reasons for this was the insecurity of life and the instability of political conditions, which destroyed effectively any incentives to accumulate surpluses. To have such surpluses would invite seizure by the local aristocracy, or by raiders from outside. As Graham, writing of past conditions in Kelantan, puts it: '..the knowledge that any superfluous property of which he (the peasant) might become possessed would speedily be annexed by some members of the local aristocracy or by satellites of the nobility... was usually sufficient to quench all ambition for the amassing of wealth. Consequently little more land was cultivated than served to supply his wants, and the man was formerly thought a fool who expended his energy in cultivating more than sufficed for these.'[4]

The power exercised by the Malay 'rajas' was absolute. The feudal system prevailed in every Malay kingdom in the Peninsula. Under this system the country was divided into a number of districts, each of which was held in fief by a 'dato' or district chief. The districts were subdivided into minor 'baronies', each held by a 'dato muda'. The villages in these sub-districts were ruled in a like manner by the 'ketua-an' or local headman.[5] All the defects and abuses likely to occur in a feudal structure of government were present—debt, slavery, heavy taxation, monopolies, perquisites, and that legacy of Hindu god-head—the *droit du seigneur*. The 'raja' had the right to call upon the 'ra'yats' or peasants to perform all manner of duties and work—to cultivate his fields as well as their own, to attend upon him when travelling, to serve as soldiers and to contribute free labour for public works.[6] In addition to the usual tithe, the peasant had to pay extra taxes on goods bought, and on such basic commodities as salt and coconut oil, and in Kedah there was even a tax on every plough.[7] Boats, crops, livestock and other forms of personal property were liable to be seized by the 'raja' without the possibility of objection or protest. Sir Hugh Clifford, speaking from experience, described the rule of the Malay 'rajas' and chiefs as 'one of the most absolute and cynical autocracies that the mind of man has conceived.'[8]

Coupled with this internal oppression was the ever present danger to life and property from outside raids. Natural calamities such as floods, drought and disease contributed to the general insecurity. It was not surprising that 'There was no competition, no stimulus to improvement... no inducement to produce

1. J.M. Gullick, 'The Negri Sembilan Economy in the Eighteen-Nineties', *J.M.B.R.A.S.*, Vol. XXIV, No. 1, 1948, pp.54-5.
2. Firth, *Elements of Social Organisation*, p.135.
3. Boeke, *Economics and Economic Policy of Dual Societies*, pp.33-4.
4. Graham, op. cit., pp.70-1.
5. Winstedt, 'A History of Malaya', p.255.
6. W.E. Maxwell, *The Law and Customs of the Malays with reference to the Tenure of Land* (Singapore, 1885), pp.33-43.
7. R.K. Wilkinson (ed.), *Council Minutes, Perak, 1880-82* (Kuala Lumpur, 1909), pp.50-1.
8. Quoted by R. Hayden, 'Malaya and the Philippines: Colonial Contrasts', *Foreign Affairs*, Vol. V, No. 2, 1927, p.331.

more than was necessary for immediate consumption.'[1] Again, the existing social standards, which demanded that all who had surpluses should contribute these to the community, tended to reduce the economic status among individuals to the same low level. The subjugation of individual needs to the paramount needs of the community, the desire to maintain the *status quo,* and the overriding importance given to the socio-religious aspects of village life, all served to stifle incentive, so that there was no internal impetus to economic development.[2]

The advent of British rule in Malaya inevitably disturbed the foundations of indigenous life. Although the policy of indirect rule was accepted in principle, the Government found the kampongs too small for the purposes of western administration, and the once autonomous units were combined into larger parcels for convenience. Each State was then divided into a number of districts, which in turn were subdivided into 'mukims', often with arbitrarily drawn boundaries, and within each 'mukim' were a number of kampongs. The communal bond was weakened as all sorts of functions formerly performed by local headmen were now taken over by Government officials. The former lost their authority and became in effect minor Government officials. Land, once held under communal tenure, came under individual ownership as western forms of tenure were introduced.

But the *raison d'etre* of colonialism was economic gain, and it was in the sphere of economic activities that the greatest changes in the indigenous society were brought about. This was not so much due to the deliberate undermining of the economic foundations of village life, as to the indirect influence of the money economy on individual members of the village. There was a gradually increasing participation in the new economy, arising at first from the need to pay taxes, rates, and so forth, and later from the desire for various goods which could be purchased with money. Almost everywhere the peasant began to produce for the market. This production above and beyond subsistence needs was made possible through the establishment of the *pax Britannica.*

Raising standards of living above the purely subsistence level depends ultimately upon the ability to produce large and regular surpluses. This in turn is conditioned by the nature of the physical environment and by the technical capacity to increase output. There is also the question of incentives. As long as the peasants were living under a subsistence economy, there was no incentive to produce more than the minimum required for survival. The intrusion of the western monetary economy into the indigenous setting increased somewhat the absolute amount of material goods considered necessary for subsistence by including some consumer articles, that were not produced before, into the range of the peasant's needs, but even then the basic needs remained limited in amount and range and were easily satisfied. As Firth has said, 'The relations between their present standards of consumption, their incomes, and their future prospects may be such in their eyes as to offer too little inducement to improve production materially.'[3] In other words, the western economic ideas and rationale of man having unlimited needs but limited means to satisfy them do not appear to operate

1. B. Schrieke, *The Effect of Western Influence on Native Civilisations in the Malay Archipelago* (Batavia, Java, 1929), pp.238-9.
2. F.L.K. Hsu, 'Cultural Factors', in Williamson and Buttrick (eds.), *Economic Development, Principles and Patterns* (New York, 1954), pp.318-64; W. Goldschmidt, 'The Interrelations between Cultural Factors and the Acquisition of New Technical Skills', in B.F. Hoselitz (ed.), *The Progress of Underdeveloped Areas* (Chicago, 1952), pp.139-40; and Firth, 'The Peasantry of South-east Asia', pp.510-11.
3. Firth, *Elements of Social Organization,* pp.11-12.

here. The peasant's means to produce might be limited but his needs are also meagre.

The limited wants and consequent lack of incentive to increase output is illustrated in the reactions of the peasant to price fluctuations in cash-crops. A rise in price does not always lead to a corresponding increase in output, but in many cases to an actual decrease because the peasant finds he can easily maintain his income at the customary level by selling a lesser amount, and does not trouble to produce as much as before. This lack of response to the price incentive has been remarked upon in many areas—in the case of padi-farmers in South-east Asia, and of cotton-growers in Africa.[1] Indeed it has often been noted that when the peasant obtains an unexpected increase in his income through rising prices he tends to squander it without achieving a real rise in his standard of living.'[2] These reactions appear to be a complete reversal of western economic laws of supply and demand, which correlate a rise in price with an increase in supply leading to a fall in demand and vice versa.

The reluctance on the part of the peasant to increase his output and earnings beyond a certain level may have earned for him the epithet of 'lazy'. But this apparent laziness may be due to the tropical climate and the lowering of physical energy caused by disease and malnutrition. To a Malay peasant living on a diet which is barely adequate for existence, 'The saviour is a short working day: a maximum of rest.'[3] But sociological factors may be as important in determining his attitude towards work and leisure, both of which are conditioned by certain conventional and social obligations.[4] The Malay peasant, used to irregular hours and to variety in his occupations, does not have the inclination or the economic incentive to abandon these for long sustained and monotonous work in a rubber estate or mine. Neither is he inclined to put in more than necessary into his own farm. He lacks the stimulus for greater profits and a larger income which drives the European and the immigrant Chinese to subjugate leisure to work.

The internal impetus to economic development is envisaged as coming through an increase in the consumptive wants of the peasants, which will in turn generate the incentive to earn more money in order to be able to satisfy these wants. Such a move implies the acceptance of the western principle of insatiability, with economic and material considerations instead of social and cultural factors occupying the foremost place in the scale of values.

However, it is impossible to shield the indigenous population from the impact of western economic ideas, and from the workings of the monetary economy. Logan has pointed out that 'Change in Africa is inevitable . . . because of world-wide economic and social forces, Africa is caught up in the relentless wheel of "progress".'[5] This remark could be applied equally well to conditions in Malaya and other parts of the underdeveloped colonial world today.[6] An indicator of the state of flux is the disintegration of traditional village life. With this disintegration a key support to social unity has been removed and a major

1. An observer writing of peasant producers in Tanganyika noted that 'When prices rise the African tends to produce less.' *The Times*, 29th September, 1955.
2. U.N.E.S.C.O., *Cultural Patterns and Technical Change* (Deventer, 1954), p. 202.
3. Vickers and Strahan, op. cit., p.2.
4. Hsu, op. cit., pp.324-5.
5. Quoted in A.L. Banks (ed), *The Development of Tropical and Sub-Tropical Countries, with Particular Reference to Africa*, pp.26-7.
6. See J. McAuley, 'Paradoxes of Development in the South Pacific', *Pacific Affairs*, Vol. XXVII, No. 2, 1954, pp.138-49.

social vacuum created. The impact of the West has been felt on family life as well, as witnessed by the abandonment of customary family houses in favour of dwellings accommodating only the immediate family unit.[1]

While on the one hand it is recognised that levels of living should be raised, on the other it is also admitted that widespread social and economic changes are inevitable if the goal is to be reached. The process of economic development occupied hundreds of years in western Europe, but it is being compressed into the space of a few decades in the underdeveloped countries, thus bringing in its wake a 'culture shock' in which religion, authority and social unity are losing their original meaning.[2] Change has already brought with it such undesirable features as 'the drift to the towns' with its attendant evils, caused by periodic unemployment, social disruption between migrant and family, village or tribe, slum living, prostitution, disease, and the like.[3] This is happening in Africa and has begun in Malaya. In Kenya, for example, more than half of the able bodied males of various tribes left their reserves as early as 1933 to work as labourers. The movement to towns was motivated by a desire to improve their standards of living by earning wages, but the consequent shortage of men in the farms resulted in losses in production which were not balanced by the wages earned, so that a fall rather than a rise in the living standards often occurred.[4]

Towns are not the only centres of employment opportunities in Malaya. The drift of the indigenous Malay population has been rather towards the large rubber estates. In 1933 these estates employed only about 3,000 Malays. By 1949 there were 69,000 Malays working in the estates as labourers. Mining remains a Chinese monopoly, and only 6,000 Malays were employed in mining in 1953.[5] Since the beginning of the Emergency in 1948, large numbers of Malays have been attracted to the police and military forces. By 1950 more than 75,000 of them had joined up, leaving many farms and fishing villages depleted of their able bodied men.[6] A local census of a smallholding community which had 1,000 males in 1937, revealed that 109 of them left it during the following ten years for a variety of miscellaneous occupations ranging from car driving to manual labour.[7]

Allied with the unwanted aspects of the drift from the land, are the more intangible but none the less important consequences resulting from change and disintegration—the loss of social and religious values. In the old indigenous societies social needs used to take precedence over even the material necessities of life, but with the loss of these values the peasants' *'raison d'etre* has disappeared'.[8] Religion and its practice where they intrude into the field of economic activities might appear to be a waste of time. But to the peasant they give him faith in

1. Schrieke, op. cit., p.239. An analysis of the impact of the West on Eastern social structures can be found in W.F. Wertheim, 'The Changing Structure of Eastern Society', *Eastern and Western World* (Bandung, 1953), pp.39-53.
2. P.C.J. van Loon, 'The Human Factor and Underdeveloped Territories', *Eastern World,* Vol. VII, No. 1, 1953, pp.16-17.
3. For a more detailed discussion see International Institute of Differing Civilizations, *The 'Pull' Exerted by Urban and Industrial Centres in Countries in the Course of Industrialisation* (Brussels, 1952).
4. Ibid., p.608.
5. *Federation of Malaya, Annual Report of the Labour Department, 1953,* pp.30-2.
6. *The Times,* 30th May, 1950.
7. Burgess and Alang Musa, op. cit., pp.5-6.
8. Boeke, *Economics and Economic Policy of Dual Societies,* p.38.

his work, and reduce the anxieties of possible crop failures, irrespective of the fact that failures continue to occur. To the Malay, the Muslim religion 'represents all morals, science and civilization'.[1] In the earlier days the money that a Malay saved was to enable him to go to Mecca rather than to raise his material standards of living.[2] To the Burmese the expression of a high standard of living was to give away money instead of spending it on himself.[3]

Economic development demands that these social and religious values be relegated to a secondary position in favour of more material considerations. During the process of inversion, however, these old values are often destroyed without anything positive being put in their place. The consequences, at their worst, are apparent in the moral and spiritual degradation that now possess, for example, such a once proud race as the Zulus.[4] Economic development may create more fundamental problems than it helps to solve.

ECONOMIC PROBLEMS OF PRODUCTION FOR THE MARKET.

The indigenous communities in the tropical colonies tend to participate in the money economy as producers of primary commodities rather than as traders, merchants, or distributors. This is partly because agriculture and fishing are the only occupation with which they are familiar, and partly because they have little desire to venture into the unknown world of competitive business with its attendant hazards. The western economic system functions by highly complicated means, with contracts, exchanges, special organisations and connections, with each link in the distributive chain from producer to consumer fulfilling a specialised role, and each existing by virtue of the profits it acquires in the course of its doing so. The entire set-up is based on money which is employed as capital and as the point of departure for profit-making. Money here is therefore used for productive and investment purposes, a procedure foreign to the peasant communities who look upon money as only a convenient medium whereby exchanges and payments can be made, and obligations settled, or in brief, who use money for consumptive rather than productive purposes. Sometimes, too, as in Muslim societies, religious tenets forbid the taking of interest,[5] while the basic intent of the monetary system is the accruement of profits and interest. It is not surprising then that the world of business remains a closed door to most indigenous tropical peoples. The problems that arise from this fact, and the results on the peasant's level of living, will now be examined, taking conditions in Malaya as an example.

The opening up and development of Malaya, at least in the initial stages, was achieved by the non-indigenous races—Europeans, Chinese and Indians. The Malays contributed little to the process. In this connection geographical factors played a significant part, for the fact that the core zone of development was along the foothill belt of western Malaya and away from the main areas of Malay settlement (which were in riverine-coastal locations, more particularly in the north of the Peninsula), meant that Malay contact with the main stream of economic activities was reduced to the minimum.

The immigrant Chinese and Indians were immersed, from the start, in the trading and commercial as well as the primary productive sectors of the exchange economy. In this they were assisted to a considerable degree by possessing certain

1. R.J. Wilkinson, *Malay Beliefs* (London, 1906), pp.7, 50-1.
2. Gullick, op. cit., p.48.
3. U.N.E.S.C.O., *Cultural Patterns and Technical Change,* pp.46-7.
4. C. Dunn, 'Figures in a Dying Landscape', *The Observer,* 30th October, 1955.
5. Firth, *Elements of Social Organisation,* pp.148-52.

qualities typical of western transients, namely, the acquisitive spirit, the ability to make rational economic decisions concerning the present as well as the future, and to curb or delay the desire for present consumption in order to sink and invest savings into the productive process. These qualities enabled them to play a full part in the economic life of the country, and to settle down in occupations which in the course of colonial development had been left unoccupied by the Malays and by the British rulers. In none of these did they succeed so well as in commerce and finance, where they occupied positions in the major banking and commercial concerns down to the village general store. By nearly monopolising the business section of the Malayan economy down to the village level[1] they were able to act as intermediaries between the commercial world and the Malays when the latter began to produce for outside markets. Similar roles were played by the Chinese in other parts of South-east Asia, and by the Indians in East Africa.

The Malays, however, did not evince any interest in trade and commerce even after they had started to produce for the world markets. Those who did show an interest were handicapped from the start by their late entry. Lacking capital as they did, the only avenue in business left was in the small retail trades. But here again several factors have worked against them. Their inadequate understanding of the working of the monetary economy, and consequent lack of business sense and experience, contributed to the failures of many small concerns.[2] The Director of Co-operation, for example, found, in the course of trying to develop marketing societies, that 'the absence of business ability among Malay peasants made rapid development and expansion impossible.'[3] Where in some cases they had both capital and the necessary experience, they discovered that they could not compete against the immigrant races because they did not have the business connections, and were soon pushed out of the trade. Discrimination against the Malays varied from outright refusals to employ them in the commercial and trading concerns, to the use of various economic machinations by those in whose interests it was to keep the Malays out of business.[4] Such discriminatory practices also occur in other countries where there are monopolistic concerns. In Malaya, however, not only the economic but also the racial aspects of the problems are involved.

Because of these factors the Malays, as a race, tend to be concentrated in occupations connected with actual production—agriculture and fishing—rather than with trade and commerce. Thus 74 per cent of the peasant primary producers in Malaya are Malays. As farmers and fishermen, the peasant population, both Malay and Chinese, suffer from several disadvantages which collectively manifest themselves in low prices. For example, Chinese market-gardeners in Perak have been known to receive only 40 cents per picul[5] for their sweet potatoes which were

1. In the 1947 census, about 90 per cent of the 156,000 persons engaged in commerce and finance were Chinese and Indians, del Tufo, *Malaya, Census Report, 1947,* Table 78, pp.444-5.
2. These were among the more important reasons for the failure of many Malay companies in the post-war period. See D.E.M. Fiennes, *Report on Rural and Industrial Development Authority, 1950-55* (Kuala Lumpur, 1957), App. E. p.52.
3. T.F. Carey, *Federation of Malaya, Annual Report of the Director of Co-operation for the Year 1948* (Kuala Lumpur, 1949), p.13.
4. *Proceedings of the Legislative Council, Straits Settlements, 1933* (Singapore 1934), p.B216. Also the *Straits Budget,* 29th December 1938; Sir Richard Winstedt, 'Sharp Practice in Malaya', *British Malaya,* Vol. XX, No. 12, 1946, pp.291-2; Firth, *Malay Fishermen,* pp.333-4.
5. 133 1/3 lb.

subsequently retailed for $1.00 per picul.[1] A two-year survey of the fish trade in Kelantan revealed that the margin between the prices obtained by fishermen and those paid by the consumer was as high as 400 to 500 per cent.[2] In Malacca, it was found that the difference between the average kampong prices and the average market prices for ten of the most common kampong fruits was at least 100 per cent.[3] The 1931 Rice Cultivation Committee discovered that padi-growers in Krian received only 60 per cent of the market value of their crop. The 1953 Rice Production Committee found that conditions had not changed, for in 1952 when the Government minimum price for padi was $17 per picul, many peasants received prices several dollars below the minimum price.[4]

The effect of the low prices on the standard of living of the peasantry varies with the extent to which they are dependent on cash-crop production. Those who specialise in producing for the market are naturally affected most. But since the majority of farmers and fishermen sell at least a part of their produce, they are to that degree the worse off for receiving poor prices, and it is apparent that their economic position would be appreciably improved if they were to receive more equitable prices for their goods.

The monopolistic rings and combines referred to earlier are the outward expression of the imperfect marketing conditions which enable the middlemen to manipulate the prices at both ends—the producer's and the consumer's. But while this monopolistic control of supply and demand is one factor responsible for the low prices received by the peasants, other factors—social, geographical, and economic—are also involved.

Distant Markets. In the pre-capitalistic economy the small surplus that was occasionally left over, after subsistence needs had been satisfied, was traded or exchanged in the periodical market fairs, which today are still extant in the more remote parts of Malaya, such as on the east coast. These fairs were held on different days of the week in different localities. Because of the insignificance of the quantities of goods bought and sold, there was no impetus to establish permanent markets which could be opened all day for most of the week. These occasional fairs were used as much for social intercourse as for trade. The characteristic feature of the trade was that each peasant was at once a seller as well as a buyer, disposing of the surplus he had for the other commodities that he happened to lack. Hence no intermediary was needed, and the farmer or fisherman dealt directly with his customer, who would also usually be another farmer or fisherman. As the market value of the goods was small and the distances involved between fairs and homes were often considerable, a marked degree of decentralisation and multiplicity of markets were necessary. The frequency and number of these one-day markets were not therefore a sign of a large volume of trade, but rather of the poverty of the peasants and of their wide dispersion.

Since the introduction of cash-crops into the rural landscape, and the general opening up of Malaya, these fairs have declined in importance, mainly because of

1. *Third Inter-Departmental Agricultural Conference. Report of Proceedings* (Kuala Lumpur, 1933), p.194.
2. *Annual Report of the Fisheries Department, Federation of Malaya and Singapore, 1948,* pp.9-12. The Fisheries Department estimates that on the average the consumers have to pay two and a quarter times the price received by the fishermen. *The Economic Development of Malaya,* p.331. Also, *Report of the Committee Appointed to Investigate the Fishing Industry* (Kuala Lumpur, 1956), App. B, Table 6, p.24.
3. G.D.P. Olds, 'A Survey of Fruit Production in Malacca Territory', *M.A.J.,* Vol. XXI, No. 2, 1933, p.62.
4. *Report of the Rice Production Committee, 1953,* p.22.

the growing specialisation of the farmers on crops, such as rubber, which have no saleable or exchangeable value for the peasants themselves. When the crops do have these values, for example, coconuts, various fruits, vegetables and fish, the surpluses could not now be absorbed by the other peasants, either because these peasants themselves grow them, or else because specialisation has brought with it a marketable surplus in excess of the rural population's needs.

The markets are now either in the urban centres or outside Malaya altogether. The peasant smallholder growing export crops is thus separated from the consumer, not only geographically but also socially. In consequence a long and frequently complicated chain of intermediate links is needed to bridge the gulf between producer and consumer. The intermediaries who forward the peasant's produce as well as supply him with imported goods, are the engrossers, processors, transporters, wholesalers, retailers, moneylenders, shopkeepers, and the like. All of them play a part in the distributive process and all of them derive their profits by so doing. The accumulated charges are usually laid at the door of both the consumer and the peasant producer. Moreover while the wholesaler dealing in large quantities may be content with a small percentage of profit, further down the chain the absolute amount of money involved becomes less, so that the percentage of charges must be increased to make the business pay. The small retailer and shopkeeper, who are the final links with the peasant producer, are consequently apt to expect a fairly large percentage of profits precisely because of the small amount of business done with each individual peasant. The final effect of these charges takes the form of low prices for primary produce. Frequently the peasant, ignorant of ruling market prices, is further exploited, and very much lower prices are quoted. In the case of rubber, however, the latest price quotations are spread by radio and telephone, and passed down to the individual smallholder by word of mouth, though in some localities day-to-day price information is lacking.[1]

Lack of Transport. There are also problems of distance, and the availability of transport between the farm and the towns and ports. Transport charges increase with distance from the market. The peasant in the earlier days found his market in the fairs. Today the markets are located in the towns and ports along the western Tin and Rubber Belt, and are very far from the bulk of the dispersed rural population. Because of inaccessibility, and the small amount of produce he can offer for sale at any one time, the peasant cannot take advantage of bulk transportation, whereas estates, also situated in the rural areas but much nearer the markets, are able to do so. Under these circumstances, the peasant has again to pay a disproportionately large amount in transport costs.

Transport costs are directly connected with transport availability. In tropical countries where agriculture, and not industry, is the economic mainstay, the volume and value of traffic are normally too small to justify heavy expenditure on roads, railways and canals to serve rural districts. Moreover, agricultural products are usually bulky and low-priced, and a means has to be found of carrying them at low cost over long distances. A combination of far-sightedness, on the part of the early administrators, and fortunate circumstances in the possession and development of tin and rubber resources, has given the impetus and means to build up in Malaya a modern transport network unsurpassed in South-east Asia. The development and pattern of this network was described in Chapter I. The fact of immediate relevance here is that the roads and railways were constructed to meet the needs of the towns, estates and mines rather than the peasant areas. This is as would be expected in a country still in the early

1. Mudie, and Others, op. cit., pp.44-5.

stages of economic development—that the limited funds available for transport construction should be expended for the benefit of those who provide the largest returns in the form of passenger and goods traffic. As the zone of greatest economic activity is the western Tin and Rubber Belt, here too, is the transport network most concentrated and elaborate.

In Malaya, as in tropical Africa, 'bringing indigenous agricultural economies within reach of modern transport facilities has been quite fortuitous, since the provision of these facilities was not intended primarily for the development of the economies.'[1] In this connection peasants in western Malaya are in a better position than those in eastern Malaya by being nearer the main urban centres and ports. A system of feeder roads has been built which links the coastal and north-western parts of western Malaya to the inland arterial highways and to the main towns. This system is specially well developed in three areas: (1) in the Malacca-Negri Sembilan region; (2) between Klang and Kuala Selangor; and (3) along the Krian-Province Wellesley part of the north-west coast (Fig. 2).

Eastern Malaya, however, remains isolated and far removed from the centres of activity. This is partly a result of the lack of a strong pulling force such as that exerted by tin and rubber in the west,[2] and partly due to the forbidding terrain and physical obstacles which make movement difficult and the construction of transport lines expensive. The high forested central ranges form a physical barrier[3] which is penetrated only by the main east-west road from Kuantan to Kuala Lumpur. Freshwater swamps stretching from Lake Bera in south-central Malaya eastwards to the lower Pahang coast, seal off approach from the south. Coastal shipping in eastern Malaya is hindered by the lack of deep water harbours, the presence of sand-bars and sand-banks across the mouths of the main rivers, and by the bad weather associated with the North-east Monsoon, so that only small coastal steamers with shallow draught are able to move with any degree of ease along this part of the peninsula.[4] The railway line connecting Gemas to Tumpat in Kelantan was completed in 1931, but the tracks were removed during the war and the line was not restored until 1954. Running along the eastern flank of the Main Range the line by-passes Trengganu altogether. Short branch lines linking the main track with the coast have not yet been built in eastern Malaya, so that the general lack of east-west connections is accentuated. The long distances and frequent detours add to the transport charges, thus reducing the earnings of the peasant living in eastern Malaya. For example, a fisherman on the Trengganu coast can only send his catch either by steamer to Singapore, or by land to Kuantan and then across to Kuala Lumpur, or by road to Kelantan and then by rail to Gemas, or across the Thai border to Perlis. In each case a journey of several hundred miles and several stages is involved.

The seven-year Federal road development plan started in 1953 envisages the construction of new trunk roads and the improvement of existing ones, notably the north-south coast road between Kota Bharu and Endau, but a 'weak feature of the programme is the absence of a co-ordinated plan for the development of feeder road.'[5] Until such time as transport facilities in rural areas are improved, the peasant will continue to have a large proportion of his cash income deducted on account of transport charges.

1. U.N., *Enlargement of the Exchange Economy in Tropical Africa,* p.40.
2. There is a possibility that cocoa may do for eastern Malaya what tin and rubber have done for western Malaya, as the potential cocoa land is mainly in Kelantan, Trengganu, Pahang and eastern Johore.
3. Average height is 4,000 feet.
4. D.F. Allen, *Report on the Minor Ports of Malaya* (Kuala Lumpur, 1952).
5. *The Economic Development of Malaya,* p.402.

Lack of Storage Facilities. Another factor which places the peasant at a disadvantage is the necessity for him to dispose of his produce quickly, partly because of the lack of storage facilities, and partly because of his need for cash. The storage of surplus crops, or fish, is influenced by seasonality of production and climatic conditions. Rubber, and to a certain extent coconuts, can be tapped or collected and marketed regularly, thus avoiding a glut and a fall in price. But with such seasonal crops as padi and certain common fruits (durians, mangoes, and rambutans), this is impossible. For instance, in all the major padi-growing areas, except Kelantan and Trengganu, there is a rush to sell immediately after the harvest, with the result that prices tend to fall to low levels. The price paid by Chinese millers in Kedah in January, when padi is harvested, is about 50 per cent lower than the price in August.[1]

Again, processed rubber can be stored for an appreciable length of time without deteriorating in quality or in value, whereas most other agricultural crops are perishable. Padi, if stored in the husk can maintain its good condition for about two years, while milled padi will not keep as long and is more liable to attacks by pests and fungus. Most ripened fruits, and fish must be disposed of quickly.

The shortage of transport facilities, and long distances to the markets put the peasant in a weak bargaining position, and he has often no alternative but to accept the low prices quoted by the middleman.[2] The high percentage of fish salted every year (one-third to one-half the total catch)[3] is another indication of the need for storage facilities and quick transport.

The peasant is frequently in desperate need of cash, and is therefore anxious to sell his produce as quickly as possible and will be content with low prices. The question of cash shortage is connected with the whole problem of the lack of savings, and the need for credit in rural areas, as well as the problem of rural indebtedness. Savings in historical times, under unstable feudal conditions, were neither necessary, practical nor realistic. No comprehensive study has yet been made of the present pattern of income, expenditure and savings in peasant groups, but such information as is available indicates a very low level of savings amongst them.[4] For example, Firth in his study of Malay fishermen in Kelantan, found that between one-quarter and one-third of the population lived on the margin of subsistence with no surplus available for accumulation.[5] Burgess and Alang Musa stated that the margin between income and expenditure in most of the peasant groups they investigated was very narrow. The common state of indebtedness amongst the peasant population provides confirmatory evidence of this lack of savings. What little a Malay peasant might be able to save would rarely be spent on improving his economic status, but would rather be expended for social and religious purposes—in weddings, feasts, and pilgrimages to Mecca.[6]

1. W.N. Sands, 'The Storage of Padi in Kedah', *M.A.J.*, Vol. XXI, No. 12, 1933, p.678. The price per picul for the 1954-55 padi crop in Kedah fluctuated from $13.50 at the and of February to $17 at the end of September. *Federation of Malaya, Final Report of the Rice Committee,* p.17.
2. T.B. Wilson, 'The Marketing of Durian Fruit from Parit Buntar, Perak', *M.A.J.*, Vol. XXXVI, No. 4, 1954, pp.211-17.
3. *Annual Report of the Fisheries Department, 1949,* pp.50, 53; and Kesteven (ed.), *Malayan Fisheries,* pp.70, 72.
4. An economic analysis of the pattern of Malay smallholder expenditure and savings has been made by Ungku A. Aziz, 'Some Aspects of the Malayan Rural Economy Related to Measures for Mobilizing Savings', in E.C.A.F.E., *Mobilization of Domestic Capital: Report and Documents of the First Working Party of Experts* (Bangkok, 1952), pp.188-93.
5. Firth, *Malay Fishermen,* p.281.
6. Burgess and Alang Musa, op. cit., pp.44-76.

Shortage of Rural Credit. Under the present circumstances, the peasant must find some means of obtaining the cash outlay required for the running expenses of cultivation, as well as for the improvement of production. The most usual procedure is to raise loans on credit. At an early stage of agricultural advance, seasonal credit is needed to carry the peasant over the period before the marketing of the crop. The credit requirements vary with the nature of the economic activities involved.[1] Thus the padi-planter and the fisherman require seasonal or short-term credit. The planter needs credit to tide him over the growing season, and the fisherman to tide him over the slack season. The fisherman may also need long or medium-term credit (repayment of which is spread over more than one season) for the purchase of boats, fishing equipment, and other capital equipment. The farmer will need such credit for the purchase of land, houses, and for the cultivation of such crops as rubber, which takes several years to mature. The Government cash subsidy for the replanting of old rubber in smallholdings is in effect long-term credit in the form of a grant.

In the absence of properly organised credit facilities the peasant has to turn to the professional money-lender, middle-man, or shopkeeper (often a single person takes on all three functions), who supplies him with the necessary credit in cash, or kind, but at a high and sometimes exorbitant rate of interest. The most common type of credit in the padi areas is that transacted under the system known as 'padi ratus' in Krian, and 'padi kuncha' in Kedah, in which the planter obtains his credit by selling his crop forward to the rice dealer, or shopkeeper, for a small fraction of its real value. It is estimated that 80 per cent of the padi-planters in the major padi regions depend upon this type of credit. They pay interest rates of up to 100 per cent in the form of the difference between the value of the crop handed over in repayment of the debt, and the actual value of the crop as determined by the ruling market price.[2]

The rubber smallholder and the coconut grower should not normally require seasonal credit. The rubber smallholder's principal contact, for economic transactions, is the village shopkeeper-cum-rubber-dealer who buys his rubber and sells him various goods, an arrangement convenient to both parties, but working to the disadvantage of the smallholder who keeps no account, and is usually over charged for the commodities he purchases. Sometimes he may require a substantial loan to open up new land or to build a house. More often he contracts a loan for a non-productive purpose—medical fees or a wedding. In either case he goes to the shopkeeper, or to the money-lender (usually an Indian Chettiar[3]), and obtains the loan on the security of his land or his holding. The Chettiar will furnish a loan up to 70 per cent of the estimated value of the land at an interest rate of 12 to 15 per cent per annum, and as long as the interest is paid regularly he will not attempt to recover the loan.[4]

Insofar as the loan is for productive purposes and there is a reasonable chance of repayment, the peasant may not be excessively troubled by high interest rates. But when the loan is contracted for a social reason the peasant soon finds himself unable to repay the capital, and in difficulties to pay even the interest. The Malay is seldom able to distinguish between the two types of credit—that for productive purposes and that for irregular consumptive purposes. 'He has little

1. The problems of providing agricultural credit for peasant farmers are examined in F.A.O., *Agricultural Credit for Small Farmers* (Rome, 1952).
2. *The Economic Development of Malaya,* p.79.
3. The Chettiars are the principal sources of long- and medium-term credit in rural Malaya. See S. Nanjundan, *Indians in the Malayan Economy* (New Delhi, 1950), pp.35-6.
4. *Fed. Leg. Co. Paper No. 50 of 1948* (Kuala Lumpur, 1951), p.C425.

understanding of the wise use of credit for productive purposes, and will readily borrow without giving a thought as to how he can repay out of his income. He does not appreciate the difference between capital and income with the result that he often has to part with his capital to repay his debt.'[1] In this he is not alone, for even the most frugal Chinese in China forgets his frugality on ceremonial occasions, and many borrow heavily in order to meet the cost of weddings, funerals and birthdays,[2] a custom continued to a great extent among the Chinese in Malaya. The habit of borrowing for social occasions by those who can least afford to do so, is also common in India, Java and the African territories.[3]

Rural Indebtedness. The low average income makes it difficult for the peasants to repay their loans. The result is either the foreclosure of mortgaged land, or indebtedness, or both. As would be expected, the extent of land lost and the amount of indebtedness, are more serious and widespread among those who borrow indiscriminately for irregular consumption. The Government Committee on Agricultural Credit found that indebtedness amongst rubber and coconut smallholders was greater than amongst padi-planters, because the former had no real need for seasonal credit. It is estimated that 40 per cent of the loans contracted led to the ruin of the peasants and to the sale of their mortgaged property.

Indebtedness is common amongst all classes of peasants, though no detailed information is available as to the exact extent of the debts as the borrowers often do not know, and the lenders are unwilling to reveal the figures.[4] A sample survey of 1,367 Malay coconut smallholdings in the Jeram Malay Reservation of Kuala Selangor was conducted by the Agricultural Department in 1932. The smallholders in about 900 of the holdings were discovered to be in debt to the dealers and shopkeepers. The monopolistic position of the dealers, and their strong hold over the smallholders as creditors, enabled them to dictate matters, and to purchase coconuts from the smallholders at one cent each instead of the ruling kampong price of 1.4 cents each. Consequently, the smallholder with a six-acre holding received an income of only $150 per annum instead of $210.[5] A Government Vegetable Oil Committee found coconut smallholders heavily in debt practically everywhere, and uncovered evidence showing that in many cases the peasants were not obtaining the full value of their produce because of their state of indebtedness.[6] Another enquiry—of 154 fruit-growing smallholders in Malacca—showed that 25 per cent of the peasants in the Central District, 23 per cent in Alor Gajah, and 20 per cent in the Jasin District were in debt. The average of 23 per cent for the whole of Malacca was below the actual figure, as many smallholders were reluctant to give information about their economic status.[7]

The very unfavourable position of peasant fishermen, as a result of their being over-dependent on the fish-dealers, was first pointed out by Stead in his survey of Malayan fisheries in 1923. He estimated that 99 per cent of the regular

1. Ibid., p.C420.
2. J.L. Buck, *Land Utilization in China* (Chicago, 1937), pp.466, 468.
3. V. Liversage, *Land Tenure in the Colonies* (Cambridge, 1945), pp.83-94.
4. An unpublished Government report on the extent of indebtedness amongst Malays in Reservations in the nineteen-thirties gave figures showing the amount of registered debts as $3,000,000; the amount of unregistered debts was not known. *Third Inter-Departmental Agricultural Conference, Report of Proceedings,* p.48.
5. F.C. Cooke and H.J. Simpson, 'Copra Production by the Malay Smallholder,' *M.A.J.,* Vol. XX, No. 7, 1932, pp.340, 344.
6. *Report of the Vegetable Oil Committee on the Present Economic Condition of the Coconut and other Oil-Producing Industries, M.A.J.,* Vol. XXII, No. 9, 1934, pp.411-2, 418.
7. Olds, op. cit., pp.60-1.

fishermen were bound to a middleman-dealer, and through indebtedness were forced to sell their catches at prices fixed by the dealer. These prices were very low in relation to the market prices, but high enough to keep the fishermen on the margin of subsistence.[1]

Indebtedness in padi-growing regions appears to be more widespread than was once thought. The Rice Cultivation Committee of 1931 received evidence that 40 to 90 per cent of the peasants in the main padi-growing areas were in debt, either to Chettiars, or to Chinese rice dealers and shopkeepers.[2] In Province Wellesley, for example, the 'penghulu' (headman) of Sungei Acheh estimated that three-quarters of the population in the district were in debt. In Penang 90 per cent of the planters in Balik Pulau District owed money to Chettiars and Chinese shopkeepers. In Kedah, half of the padi-growing population was in debt for varying amounts. Similar figures were quoted for other areas. A common cause of indebtedness was the granting of credit under the 'padi ratus' or 'padi kuncha' system, under which interest rates were anything up to 100 per cent.[3] The 1953 Rice Production Committee reported scarcely any change in the general position. The system of 'padi kuncha' was found to be most prevalent in Krian, Province Wellesley, Kedah and Perlis.[4] Burgess and Alang Musa stated that out of forty-two households in a padi-growing district in Malacca, forty were in debt to a total sum of $3,320, and that these debts were incurred largely in order to purchase food and clothing, but some were contracted for social functions, the purchase of seed and manure, house repairs and other miscellaneous forms of expenditure. Of the total sum, 68 per cent was owed to shopkeepers, 17 per cent for pawned articles, 10 per cent to cloth-merchants, 4 per cent to friends and relatives, and 1 per cent to the Government.[5]

It is evident that under these conditions there can be no improvement in peasant standards of living. Shackled as they are to the middlemen, money-lenders and shopkeepers by the bonds of their debts, any fruits of improvement will go immediately to the creditors in the form of interest payments and high prices for consumer goods. To prevent this, a means of providing the necessary credit facilities under equitable terms must be substituted for those provided by the money-lender. But as stated by Calvert, '... no government organization, however benevolently intentioned, can reach the great mass of its people scattered over the whole of the area under its administration, even in a wealthy country... In the lesser developed countries only the fringe of the problem could be touched by this agency.'[6] In Calvert's opinion the only practical solution was the co-operative credit society.[7]

Co-operatives in Rural Malaya. The co-operative movement in Malaya started in 1922, when the Co-operative Societies Ordinance was introduced in the Federated Malay States. Among others founded were six rural credit societies with 182 Malay planters as members and a working capital of $2,000. In the period from 1922 to 1939, the rural credit co-operative society, as an answer to

1. Stead, op. cit., pp.60, 126, 211-15.
2. *Report of the Rice Cultivation Committee, Vol. I,* p.40.
3. *Report of the Rice Cultivation Committee, Vol. II,* pp.108, 111, 114.
4. *Report of the Rice Production Committee, 1953,* pp.21-2.
5. Burgess and Alang Musa, op. cit., pp.68-70.
6. Quoted in E.C.A.F.E., *Mobilization of Domestic Capital through Financial Institutions of the E.C.A.F.E. Region* (Lahore, 1951), pp.126-7.
7. Ibid. For an account of the place of co-operative societies in agricultural development, see U.N., *Rural Progress through Co-operatives* (New York, 1954), pp.37-51.

the money-lender, made very little progress. In 1939 the number of such societies was only eighty-six. The number rose to 218 in 1948, but the total membership was only 7,000.[1] This total represented less than 1 per cent of the 750,000 working population classed under the rural peasant category. 'As far as the problem of rural indebtedness is concerned, the rural credit movement has only scratched the surface. Most of the loans made by these societies are unproductive loans to finance expenditure on sickness, confinement, weddings, funerals and repairs to houses. Only a small proportion is for productive purposes.'[2]

There has been some progress since then, and the number of rural credit societies rose to 600 in 1955 with a total membership of about 30,000, composed mostly of padi-planters in the 'rice-bowl' of Perlis, Kedah, Krian, and Province Wellesley.[3] But this membership represents less than 4 per cent of the rural working population.

In an attempt to minimise the imperfections in marketing conditions, the co-operative movement was extended to cover the processing and marketing of smallholder produce. Co-operative rubber processing societies were first tried in 1930. The three small factories set up did manufacture a better grade rubber than the usual smallholder product, but all three failed by 1933 owing to the lack of discipline necessary for successful co-operation.[4] Faced with this failure, attention was turned, after the war, to experimenting with the bulk-purchase of smallholder latex which was later either sold to large firms as latex, or else bulk-processed by the buying units. The smallholder was saved the trouble of processing his own latex, and he could at the same time obtain a fair price for it. Five experimental buying units were established in Kedah and two in Perlis in 1949.[5] Started as a direct Government attempt, rather than as a co-operative effort, the units were maintained by officers from the Department of Agriculture and the Rubber Research Institute. But when at the end of 1950 these officers were withdrawn, as part of the policy of allowing the peasants to run the business themselves, the working efficiency broke down and the whole scheme failed.[6]

Co-operative Rubber Marketing Societies were only slightly more successful. In 1952 there were twenty-three such societies, and twenty-five by 1953. Members of the societies process their own rubber and sell the products to commercial firms at better prices than could be obtained from the middlemen-dealers. It is significant that one of the most successful societies—the Ulu Langat Rubber Marketing Society—was started only after all the private rubber dealers' licences in the area were cancelled, leaving the Society with a clear field in the purchase of smallholder rubber.

Progress in the establishment of marketing societies for other produce was likewise slow. In 1953, apart from the twenty-five Rubber Marketing Societies, there were also ninety-two Rice Milling, ten Fish Marketing, one Coffee Marketing, and two Oil-Milling Societies in Malaya.[7]

1. Lim Tay Boh, *The Co-operative Movement in Malaya* (Cambridge, 1950), pp.4, 6, 10.
2. Ibid., p.21, Also T.F. Carey, op. cit., p.11.
3. R.C. Gates, quoted in *The Malay Mail*, 24th August, 1955.
4. Lim Tay Boh, op. cit., p.23.
5. J. Cook, 'The Purchase and Bulk-Processing of Smallholding Latex', *M.A.J.*, Vol. XXXIII, No. 3, 1950, pp.136-43.
6. J. Cook, 'Further Notes on the Marketing of Smallholding Latex', *M.A.J.*, Vol. XXXVI, No. 3, 1953, pp.181-9.
7. T.F. Carey, *Federation of Malaya, Annual Report of the Commissioner for Co-operative Development, 1953* (Kuala Lumpur, 1954), pp.6-8.

It is clear that the co-operative movement in Malaya has not been a success. As Jones has pointed out, the movement 'had only traversed the edge of the problem of debt and poverty; the untouched areas were so vast that not only had it become imperative that the co-operative movement should receive far greater support but also that the whole problem should be given priority of attention.'[1] A similar lack of success has been recorded in those other parts of Asia where co-operatives have been tried as an alternative to usury. In most of Asia money-lenders still predominate in the rural areas, and affect a far larger number of people than the co-operatives.[2] In South-east Asia as a whole the movement has made hardly any real progress.[3]

The ineffectiveness of the rural co-operative movement in Malaya cannot therefore he said to be an isolated case in the South-east Asian regional context. Yet the communal bond which draws the Malay peasants to do certain tasks together—erecting fences, burning padi straw immediately after harvest as a protection against the padi-borer, draining the fields, and the like—has frequently been held to be a sign that the co-operative movement would fit easily into the pattern of rural life. But as explained by Boeke, co-operatives are a western institution based on the money system and on the exchange economy, and working on principles unknown to an indigenous society.[4] Western co-operation depends on individual collective effort working towards a common end, namely the future benefits of its members. It is without the organic bases that characterize non-western social groups.[5] The success of co-operative organisations in Europe and North America is no proof that similar organisations superimposed upon non-western communities, with low educational levels and a rudimentary knowledge of the cash economy, would succeed.

Several other local factors have contributed towards the ineffectiveness of the movement in rural Malaya. One of the most important of these pertains to the Muhammadan rule prohibiting usury. Thus, when it was suggested in 1907 that co-operative societies should be introduced into Malaya, a committee of enquiry appointed to look into the matter reported that it was not likely that 'such a system could ever be successfully promulgated among the Malays', as it was '... entirely against the tenets of the true believer of Islam to take interest on money lent out. This being so at once disposes of the system suggested to be considered as far as co-operation among Muhammadans is concerned.'[6] It was not until eleven years later, after the President of the Muhammadan Advisory Board and the ruling Sultans had issued a statement that co-operation was a permissible act, that the religious opposition was officially removed.[7] But many strongly religious Malays continued to resist the movement, and many rural Malays are still not prepared to accept this from of organisation.[8] There are some signs that this attitude is slowly changing, but, until it does, there is little chance of the movement achieving its objectives.

1. Jones, op. cit., p.66; also Ungku A. Aziz, op. cit., p.192.
2. E.C.A.F.E., *Mobilization of Domestic Capital through Financial Institutions of the E.C.A.F.E. Region,* pp.7-8, 95.
3. Jacoby, op. cit., p.23.
4. Boeke, *Economics and Economic Policy of Dual Societies,* pp.34-5.
5. U.N.E.S.C.O., *Cultural Patterns and Technical Change,* p.199.
6. Quoted by A. Cavendish, *Co-operation as a Subject for Study in Malaya* (Penang, 1922), p.3.
7. Ibid, p.6; see also 'Notes on Malaya', *British Malaya,* Vol. IV, No. 9, 1930, p.274.
8. B.J. Surridge, *Co-operation in the Federation, 1950* (Kuala Lumpur, 1954), p.B6.

One of the reasons for the failure of many co-operatives up to 1931 was the shortage of staff, and the unreliability of inspecting officers. It was estimated that it would require twenty-five to thirty years to train the necessary officers.[1] The war interrupted progress, and after the war lack of funds hindered administrative as well as propaganda work. In spite of this, there was a rapid expansion of all types of societies between 1950 and 1952. In fact, expansion was over-rapid and led to many failures, because the new societies were registered without the members being fully aware of the basic principles of co-operation, and because the officers had not been given the necessary instruction in the running of the societies.[2] Many members, and some officers, lacked the discipline, and a few the integrity, needed for successful co-operation. The result was bad management and in one case a large sum of money was lost through embezzlement.

The majority of Malayan peasants still depend on the village shopkeeper for most of their economic transactions. Many of them are bound by debt to the shopkeeper, who uses this hold upon them to prevent them from forming a society. In other cases, the peasants prefer the cash price offered by private traders to the lower price and later dividends offered by a co-operative society.

The co-operative movement in Malaya was initiated by the Government, and has always depended upon the Government for assistance in funds and administration. Under the prevailing conditions in Malaya, as in the other underdeveloped areas, it is unlikely that the movement could ever gain sufficient momentum and strength if left on a voluntary basis, although the basic principle of co-operation in the West is that it should be a voluntary movement of spontaneous growth. To the peasants, therefore, the Co-operative Department is just another Government Department, and as such they tend to regard it with suspicion. The rules and regulations that must be observed have proved irksome to many, and one of the reasons given for the lack of progress in rural areas was the over-rigidity of the whole system.[3] Experience in Africa has also shown that where the movement was government-sponsored, it failed.[4]

The basic assumption made by the Government in Malaya, when establishing the rural credit societies, was that by providing the peasant with a means of borrowing at low rates of interest, he would automatically turn away from the money-lender. This might be expected to happen in economically more sophisticated countries where the main incentive to borrow is the expectation of future profit. But borrowing for productive purposes among the Malay peasants is the exception rather than the rule. Their religious and social customs demand lavish expenditure for a wide variety of festivities, in which social prestige is at stake. In Malay society, as in Nigerian, thrift is a 'denial of traditional open-handedness.'[5]

Under the circumstances, the loans contracted are limited, neither by necessity nor by prudence but by the ability to borrow, which is determined by the security the peasant can offer. His realisable assets are usually small, while the small size of the farm and the low income limit the amount of savings possible. Since the funds from the rural credit societies come from the members themselves,

1. *Report of the Rice Cultivation Committee, Vol. II,* Pt. 2, p.93.
2. T.F. Carey, *Annual Report of the Commissioner for Co-operative Development, 1952* (Kuala Lumpur, 1953), p.1.
3. *Report of the Rice Production Committee, 1953,* pp.42-3.
4. C. Leubusher, op. cit., pp.184-7.
5. *Nigeria, Annual Report of the Registrar of Co-operative Societies for the Year 1947-48* (Lagos, 1949), pp.6-7.

only a few peasants have the necessary savings and assets to start a co-operative society. Many joined under the impression that the society existed for the purpose of furnishing loans at low interest rates for the mere asking. Loans were frittered away on buying consumer goods, and on non-productive expenditure.[1]

The Malay has always been very slow in repaying his loans. Among themselves, they have no fixed ideas of exact dates for repayments. The Muhammadan law favours the debtor, and the Koran states that the borrower's convenience must be respected.[2] This renders the Malay peasant an unsatisfactory member of a semi-official society which always seeks to avoid unnecessary risks. The society is also reluctant to lend money for non-productive purposes. The shopkeeper-cum-money-lender, however, is willing to lend on little more than personal security, and without enquiring too closely as to the object of the loan. Being in intimate contact with each customer, and confining his business to a small kampong, he is able to assess without special enquiry, the credit-worthiness of each customer, and is also at hand to recover the interest and the loan capital at intervals. Often the peasants are unwilling to repay loans, or are unable to do so, because of adverse circumstances. The risks of bad debts are consequently high, and since the security offered is also of doubtful worth, the rates of interest would naturally tend to be higher than usual, although the net profits of the shopkeeper-money-lender may not be as excessive as commonly supposed. As a condition of his loan, the peasant is compelled to sell all his produce to, and make all his purchases from, the shopkeeper. This affords the shopkeeper triple profits from the transactions, and is also a powerful instrument for the recovery of debts. The peasant is in no position to make any strong protests as to interest rates, weights, quantities, or prices. On the other hand, complete repayment of the loan is seldom insisted upon as the shopkeeper cannot afford to lose such a valuable client. The peasant, on his part, by borrowing from the friendly shopkeeper, is able to avoid all the formalities, examinations of personal affairs, long delays and periodical inspections involved in borrowing from a Government agency, or a co-operative society.

The result, however, may be life-long economic bondage through perpetual indebtedness. In historical times the debtor who could not pay his debts became a personal slave to the creditor, or sold his children as slaves.[3] Today, however, the law forbids slavery but not economic bondage. Also in '... the old days of native rule a bad harvest meant a general curtailment of the wedding festivities. In the present age of security and peace, the beneficent alien money-lender is always ready to make up for the dificiencies of the crop. The marriage ceremonial has become more elaborate than ever, while the people are sinking more and more into debt.'[4]

As long as money is borrowed for social rather than economic reasons the peasant will remain exposed to all the disadvantages of high interest rates, high prices for his purchases, and low prices for his produce. The problems of low prices, and their effect on the standards of living of the rural population, are

1. The *Singapore Standard,* 26th July, 1955. This has also been observed among Burmese peasants; see H.J. Frietema, 'The Establishment of Co-operation with Special Reference to Experiences in Burma', *Netherlands Journal of Agricultural Science,* Vol. I, 1953, pp.256-65.
2. J. Rigby (ed.), 'Law, Part II. The Ninety-nine laws of Perak', *Papers on Malay Subjects* (Kuala Lumpur, 1908), p.27.
3. T.J. Newbold, *Political and Statistical Account of the British Settlements in the Straits of Malacca, Vol. I* (London, 1839), p.141; see also Wright and Reid, op. cit., pp.319-40.
4. Wilkinson, 'Life and Customs, Pt. I. The Incidents of Malay Life', p.29.

thus as much connected with the socio-religious factors, which press upon the peasants to spend lavishly and beyond their means without a thought about the consequences, as with market imperfections, lack of transport and the non-availability of cheap credit. Too often attention has been focussed solely on the latter ,and the socio-religious factors relegated to the background, possibly because the latter apparently admit of easier solution than the former, which belong more to the field of education rather than of economics. Yet, unless these attitudes towards money, credit, and extravagant expenditure are radically altered, the chronic state of widespread indebtedness will persist and the peasants will not progress beyond the margin of subsistence.

THE RURAL AND INDUSTRIAL DEVELOPMENT AUTHORITY (RIDA).

Until 1950 the only agency which was directly concerned with assisting the peasantry in the economic field was the semi-official Co-operative Department, which, as seen earlier, has met with very limited success. In 1950 the Federal Government created an interim organisation known as the Rural and Industrial Development Authority (RIDA) which had no specific directive except that of 'stimulating the development of the rural areas (which are populated by Malays and in which the bulk of the Malay population lives), and in that way the Malays' economic level could be brought up to that of the other communities quicker than it otherwise could be.' Later its purpose was widened to include 'rural and industrial development as a whole' and not exclusively Malay development.[1] RIDA began operations in 1951 with a block vote allocation of $5,000,000 from the Government. During the first three years of its life, it remained a separate Government Department. In January 1954 it was incorporated by Ordinance. Its powers were also widened (for example it now had the power to acquire, by compulsion, land and other immovable property), and it was given a greater degree of freedom in carrying out its duties and functions.[2]

The functions of RIDA are, firstly, 'to promote economic development proper through improved methods of production, processing and marketing', and secondly, 'to assist the rural population to improve its living conditions by the provision of better essential services and amenities.'[3] The programme for 'economic development proper' provides mainly for development 'projects'. These are loans and enterprises made by RIDA, in which the capital is employed with a view to earning revenue, which is to be conserved in an investment fund. This fund, known as the Rural and Industrial Fund, is capitalised by grants from the Federal revenue surplus, or from loan funds which are given in the form of outright grants. The Fund makes loans to groups and individuals, and also provides capital for enterprises established under direct aegis, after it is satisfied that the borrower, or enterprise, is a sound business proposition able to pay the interest rates (4 to 6 per cent per annum), repay the capital or loan within ten years and make a profit.

The rural improvement programme, on the other hand, provides for 'schemes' only, a scheme being a proposition which necessitates outright expenditure of cash, and one from which no profits are expected. The principle on which RIDA is based is that of 'self-help', whereby the community which benefits from a project or scheme is expected to contribute free labour, materials, or cash for it.

1. *Fed. Leg. Co. Paper No. 24 of 1952* (Kuala Lumpur, 1952), p.3.
2. *Fed. Leg. Co. Paper No. 48 of 1953* (Kuala Lumpur, 1953).
3. *Fed. Leg. Co. Paper No. 65 of 1952* (Kuala Lumpur, 1952), p.5.

RIDA works through a series of Development Boards erected on the existing administrative structure. At the Federal level is the Authority consisting of the Chairman, the Deputy Chairman, and eleven State members, and twelve other appointed members working with the Executive and Planning Committees.[1] Below this is the State Development Board established by the local Government, and empowered to approve proposals and plans below certain financial limits. On the District level is the District Development Board, and lastly, the Village Development Board. The last two are responsible for the small local enterprises and schemes.[2]

As an instrument for the promotion of economic development in the rural areas, RIDA represents a concrete attempt by the Federal Government to play a more decisive role in a hitherto neglected sector of the national economy. It is a step forward from the haphazard laissez-faire attitude, characteristic of a colonial economy, towards the direction whereby future growth in the rural areas is shaped and guided to some degree by conscious planning. The duties of the Authority—'to stimulate, facilitate and undertake economic development in the Federation, and more particularly in the rural areas thereof'[3]—are sufficiently wide, and the directive 'sufficiently elastic to allow it to assist the rural population in many ways which would not at first sight be within its purview.'[4] It would be appropriate to review the work of RIDA, and to see how far it has succeeded in attaining some of its objectives.

In the field of economic development RIDA's activities fall into two categories. Firstly, it has taken on the work of a financing agency, providing long- and medium-term credit for a number of small rural enterprises. The loans are given for a period not exceeding ten years, and at maximum interest rates of 6 per cent per annum. Here RIDA functions as an alternative to the Chettiars and other money-lenders as a source of credit. But because of the lack of funds, its scale of operations has been extremely limited. Up to the first half of 1953, for example, only 195 separate loans were approved for the whole of Malaya, involving a total sum of about $1.8 million.[5] The Authority also provides short-term seasonal credit for co-operative societies, mainly to those in padi-growing areas. For example, a sum of $927,000 was loaned to the Co-operative Banking Union in the main padi areas in 1953 for the specific purpose of counteracting the inequitable system of rural credit known as 'padi kuncha'.[6] The results 'were successful within the limits of the funds available, but RIDA's work in this field indicates the need for a well established system of rural credit on a larger scale than the Authority's resources permit. Not only in connection with rice production but in connection with nearly every main crop, including fishing, there is widespread indebtedness under inequitable systems which a Government-organised system of rural credit would do much to eradicate.'[7]

Many millions of dollars are needed if there is to be a substantial progress in this direction, but up to the end of 1954 only the fringe of the problem had been touched. It is inevitable that shortage of funds should be a limiting factor

1. *Fed. Leg. Co. Paper No. 48 of 1953*, pp.331-2.
2. *Fed. Leg. Co. Paper No. 10 of 1951* (Kuala Lumpur, 1951), passim.
3. *Fed. Leg. Co. Paper No. 48 of 1953*, p.331.
4. *Fed. Leg. Co. Paper No. 35 of 1953* (Kuala Lumpur, 1953), p.26.
5. *Fed. Leg. Co. Paper No. 84 of 1953* (Kuala Lumpur, 1953), Schedule III, pp.60-8.
6. *Fed. Leg. Co. Paper No. 45 of 1954* (Kuala Lumpur, 1954), p.4. The amount loaned for this purpose in 1954 was $1.4 million, see *Federation of Malaya, Annual Report, 1954*, p.197.
7. Ibid., p.5.

to the effectiveness of RIDA, as it has to spread its available finances over such a wide range of activities. Here RIDA encounters a problem which, to a certain extent, is common to all similar organisations. It is whether to interpret the terms of its duties literally, and help to ameliorate and improve living conditions in all sectors of the rural economy, thereby spreading its financial and other resources thinly over the whole country without perhaps doing much to solve any one problem, or alternatively, whether to concentrate on a few pressing problems at a time, and try to solve these or get as near to solving them as possible before passing on to others. Ideally a simultaneous attack on all the factors which hinder rural development would be preferable to a limited attack on some of them. But there are many practical difficulties in the way of achieving the ideal, and, as seen above, a major one is lack of finance.

Secondly, RIDA has also taken on the task of directly initiating, managing and running various economic enterprises. In the field of rubber processing and marketing the Authority's contribution was mainly in the form of loans to the co-operative societies connected with this aspect of agriculture. But it has, itself, built a large factory at Grisek in Johore, where smallholders may send their latex to be processed. The factory came into operation in April 1953, but immediately ran into a 'considerable number of teething troubles'.[1] The major difficulty arose from the fact that it had to process 4,000 lb. of latex daily in order to cover its running costs. Before its construction, RIDA assumed that the smallholders in the area would be able to provide the necessary amount of latex. Later, when it was completed, the management discovered that private rubber dealers were offering higher prices to the smallholders as a competitive measure. The smallholders were consequently attracted to sell to the dealers rather than to the factory, which was thus obliged to run at a loss.[2] It would appear that in deciding to build the large factory[3] the Authority omitted to gather the necessary data on the expected response from the smallholders, relying rather on their promises of loyal support. It was later decided to carry out a survey of smallholders and smallholdings in the Grisek area, in order to obtain an accurate background knowledge of the factors which make for the economical running of smallholders' factories.

The aim of RIDA, declared its Secretary early in 1951, was to turn it into a produce marketing and processing organisation. Every village was to have its produce buying store where the peasant would be able to sell his latex, padi, copra or fish. These were then to be processed, graded and packed at a central point and sold as first-quality commodities. The peasant smallholder would thus be able to enjoy the benefits of direct trading, and obtain more for his labour by eliminating the excessive charges of the middlemen.[4] But in the four years 1951-54, the only direct project undertaken by RIDA towards this proposed end was the Grisek Rubber Factory which, as noted, was virtually a failure. The reasons given for this lack of progress in processing and marketing were shortage of staff and lack of funds.[5]

The other major ventures of RIDA in directly-managed enterprises were the Telok Kumbar Fisheries Project, the Kuala Trengganu Dockyard Project, and the provision of tractor services in nine of the States. The Telok Kumbar Project envisaged the purchase of a vessel equipped with an insulated ice-hold and

1. *Fed. Leg. Co. Paper No. 84 1953*, p.11.
2. T.F. Carey, *Federation of Malaya, Annual Report of the Commissioner for Co-operative Development*, 1953, pp.7-8.
3. Its cost was $333,500.
4. *Straits Times*, 20th January, 1951.
5. *Straits Times*, 1st December, 1955.

mechanical fishing gear, at a cost of sixty to seventy thousand dollars. The vessel would be used by peasant fishermen for weekly round trips to distant fishing grounds, which were expected to yield bigger catches and higher earnings than close inshore fishing with non-powered boats. Prior to the purchase of the new vessel the gear was fitted to a Fisheries Department boat as an experiment for a trial period.[1] The experiment proved a failure because of 'severe competition from vested interests', and also because the fishermen were reluctant to stay away at sea for five to six days.

Also, RIDA purchased a fleet of sixty-five tractors at a cost of $566,000. These were distributed to all the States (except Malacca and Perlis), to be hired out to padi-planters for mechanical ploughing.[2] However, it was soon discovered that the average peasant padi-grower was unable to meet the charges for tractor ploughing.[3] By the end of 1954 most of the tractors were operating at a loss, and the plan had become a heavy burden on RIDA's finances. The venture has, however, awakened interest in the private ownership of tractors. Many farmers now want to buy their own tractors, and are applying for loans in order to be able to do so.[4] In view of the uncertainty about the use of the tractor for padi-cultivation, and the ignorance of the average Malay peasant of such technical matters as costs, repairs, depreciation, length of life, as well as the lack of servicing facilities in the rural areas, it may be queried whether the tractors may not turn out to be expensive white elephants, especially since the ploughing period occupies only two months or so in a year and the machines must perforce remain idle for the remainder of the year.

RIDA's most ambitious venture was the Trengganu Dockyard Project. It called for the construction of a modern dockyard at Kuala Trengganu as a centre for boat-building. The project was to be completed by the end of 1953, and was estimated to cost two million dollars. By the end of July 1954, however, only the first of the four stages had been completed, though more than one and a half million dollars had already been expended. An extra million dollars was estimated to be needed before the yard could be finished.[5] The unsatisfactory state of the project was made public, and RIDA decided to scrap the original plan, and convert the dockyard into a training centre for boat-building, woodwork, blacksmith work, marine engine maintenance, and navigation and driving instruction. The reason for the failure was said to be the lack of a market for very large fishing craft, and therefore the project was 'no longer fulfilling the objects for which it was created.'[6]

It will be seen that most of the major projects which RIDA started were financial failures, involving substantial losses which it could ill afford.[7] In another sphere of the rural economy—that of the cottage industries—RIDA has adopted a more cautious approach. It instituted a number of economic surveys, and gathered basic data as a preliminary to more positive action.

1. *Fed. Leg. Co. Paper No. 24 of 1952,* pp.10-11.
2. *Fed. Leg. Co. Paper No. 84 of 1953,* p.4, and Schedule II, p.59.
3. *Report of the Rice Production Committee, 1953* p.30.
4. *Straits Times,* 1st December, 1955.
5. *Singapore Standard,* 27th July, 1954.
6. *Straits Times,* 4th December, 1954.
7. Seventeen out of a total of twenty-three RIDA projects were run at a loss in 1954, the total loss incurred being $500,000. *RIDA Annual Report, 1954* (Kuala Lumpur, not dated), pp.31-31a.

Traditional Malay handicrafts range from the purely utilitarian (such as pottery, mat, basket and atap-making, and cloth weaving) to the semi-luxury and luxury articles (such as lace, embroidery, silver and gold).[1] The large scale import of cheap factory manufactured goods has led to a decline of many of these local industries. The utility market has everywhere been captured by imported articles, and only some of the local luxury industries remain, such as, the weaving of 'batek sarongs', and the skilled working of gold and silver objects for which Kelantan and Trengganu craftsmen are renowned. An economic survey financed by RIDA in 1951 revealed that there were 919 sarong-weavers in Kelantan, 2,000 in Trengganu and less than 200 in Pahang, Johore, Kedah and Perlis.[2] Eighty-eight per cent of the weavers in Kelantan were dependent on middlemen who paid for the labour and supplied the thread. The monthly earning of 94 per cent of the weavers was between $1 and $20. There were also 125 goldsmiths and 74 silversmiths in Kelantan whose monthly earning ranged from $49 to $149.[3] An enquiry conducted by the Labour Department in 1954 found that many of the country's light industries were suffering severely from competition from abroad. For example, Kelantan's 'batek sarong' industry, which had been employing 2,000 workers and handling some 400,000 yards of cloth each month, was virtually dead.[4]

RIDA's efforts at helping the cottage industries were mainly in the form of loans to private craftsmen and organisations. Up to the middle of 1953, twenty-two such loans involving a sum of $108,300 had been approved.[5] In 1953 an expert from the International Labour Organisation carried out a country-wide survey of Malaya's handicrafts. Following his recommendations, RIDA is attempting to revive the industries. The work is to be carried out in two stages. First, it plans to organize an increased production of silverware, sarongs, baskets, pottery, and so forth which will be sold in the home market. After this, an effort will be made to market the articles overseas. The Authority is to act as an agent for the craftsmen, paying them cash for the articles and selling to home and overseas buyers, thereby eliminating the middlemen and ensuring that the craftsman obtains a fair return for his labour.[6] The success of this venture depends ultimately on whether Malayan products can compete, in terms of quality and price, with foreign goods. As far as prices are concerned, the decline of many of the rural industries is evidence that the mass-produced imported items are much cheaper than the home products. Whether the Government should step in with protective measures has been considered by the International Bank Mission, who warns that protective measures '. . . which merely excluded cheaper foreign products, and forced Malayan purchasers to buy more costly home manufactures would result in an absorption of capital and resources which might better be employed in other lines.'[7] How far RIDA is able to put the cottage industries on a stable footing in the face

1. I.H.N. Evans, *Malay Arts and Crafts* (Singapore 1923); R.O. Winstedt, 'Malay Industries, Pt. I, Arts and Crafts', in *Papers on Malay Subjects* (Kuala Lumpur, 1909); and C.A. Gibson-Hill and A.H. Hill, *Malay Arts and Crafts* (Singapore, 1951).
2. J.M. Gullick, 'A Survey of the Malay Weavers and Silversmiths in Kelantan in 1951', *J.M.B.R.A.S., Vol.* XXV, No. 1, 1952, p.138; also A.H. Hill, 'The Weaving Industry in Trengganu', *J.M.B.R.A.S.,* Vol. XXII, No 3, 1949, pp.75-84.
3. Gullick, 'A Survey of the Malay Weavers and Silversmiths in Kelantan in 1951', pp.142-7.
4. *Singapore Standard,* 23rd October, 1954.
5. *Fed. Leg. Co. Paper No. 84 of 1953,* p.24.
6. D.H. Horton, reported in *Federation of Malaya, Weekly News Summary* for the week ending 13th November, 1954, pp.9-10.
7. *The Economic Development of Malaya,* p.124.

of outside competition, or whether it will again incur heavy financial loss in this attempt, remains to be seen.

RIDA has been more successful in the 'schemes' it has sponsored, although these have not resulted in any direct raising of the peasants' incomes. The Authority's work here has been in two directions. Firstly, it has made outright grants towards such items as the construction and improvement of communications in the rural areas, small electricity and water supplies, schools, community centres, mosques, playing fields, and other amenities. But because of the limited funds available, work has necessarily been on a small scale.[1] Until lately the villages that have benefitted from one or more of these schemes have been called upon to contribute an equivalent, or near equivalent amount (in cash, labour or materials), towards the cost as part of the Authority's idea of promoting self-reliance. Secondly, RIDA has also established, in co-operation with other government departments, a number of training courses in practical subjects, particularly in agriculture, in the mechanical trades, and in commercial and domestic subjects. In addition, special training courses for village headmen are held regularly at the Serdang Agricultural College. These are designed to introduce the headmen to new ideas and to overcome their conservatism towards these ideas.

The total sum of RIDA's efforts at rural betterment has not so far been very substantial. The major economic problems of rural credit and indebtedness, and of marketing and processing, still remain unsolved. Shortage of funds and staff is tied up with this lack of progress. In this connection, it is to be wondered whether the existing administration has not in fact become over-heavy in that too large a proportion of the existing available funds are being spent in keeping it going each year. For example, of the $4,000,000 earmarked in 1954 for expenditure on schemes, propaganda, and administration, $1,383,000 were spent on wages, salaries and other recurrent and special administrative charges alone, leaving a sum of $2,617,000 to be expended on actual schemes and other work.[2] In other words, administrative charges drained away more than one-third of the RIDA funds for that year.

Several other factors have also been responsible for the slow start and lack of progress shown by RIDA. The most important was probably the initial hostility shown by some States who feared that their administrative functions would be interfered with or even superseded by RIDA.[3] Inter-State rivalries and jealousies also impeded progress to some extent.[4] The Authority's constitution limited its activities to the launching or assisting, or both, of schemes proposed by the States, but the response from the States was so poor during the first year of its existence that only about one-eighth of its allocation of $5,000,000 was spent. The Emergency in the Federation also hampered the work of RIDA in the early days, not only with regard to the demands the war effort made on skilled administrative personnel, but also directly in rendering the more remote rural areas unsafe to work in.

Another disadvantage was, and still is, its complex bureaucratic nature. The administrative machinery with its over-complicated structure centred on the Authority at the Federal level made it necessary for decisions, plans and schemes to pass through a long process of consideration and scrutiny at each level before

1. For the first half of 1953, for instance, a total sum of only $619,000 was spent in schemes spread over the eleven States. *Fed. Leg. Co. Paper No. 84 of 1953*, App. B, p.53.
2. *RIDA Federal Estimates, 1954, and Revotes, 1953* (Kuala Lumpur, 1953).
3. *Fed. Leg. Co. Paper No. 24 of 1952*, p.3.
4. C. Gamba, 'Rural Development in Malaya', *Eastern World*, Vol. VI, No. 5, 1952, p.20.

they were finally approved. Plans formulated by the Kampong Development Boards had to go through the Mukin, District and State Boards before reaching the Executive in Kuala Lumpur, and the decision taken on them would then have to filter back to the village level before work could be started. The Grisek Rubber Factory Project, for example, had to go through several months of 'bureaucratic delays' before a start could be made.[1]

Up to the present, therefore, RIDA has not made any solid impact on the rural landscape. None of the large scale economic projects can be said to have succeeded, and, although there has been some progress in the schemes for improving rural amenities the scale of RIDA's operations here has too often been handicapped by insufficient funds. Because these schemes are not expected to be profit-making enterprises (and hence cannot incur losses), there is also the danger that the Authority may tend to concentrate on them to the exclusion of the projects designed to solve the outstanding problems of rural indebtedness, marketing, and others, and thereby to develop gradually into a loosely organised uplift council benevolently distributing funds for approved use. It may be questioned whether any real progress can be achieved through its policy of attempting to enter into all and every type of activity, with neither the specialised staff to handle them nor the funds to sustain them. In 1954, for instance, RIDA had its hand in the following activities: rice and rubber production, fisheries, animal husbandry, arts and crafts, light industries, commerce in the rural areas, transport and communications, water and electricity supplies, training, housing, industries derived from coconuts and in rural amenities and improvement. A sum of $5,928,000 was allocated for the year for work on these fourteen separate and distinct items, the money to be distributed amongst the eleven States.[2] If there were equal shares, then each State would receive about $630,000, an amount which would have to be divided again for expenditure under the separate subjects classified for development, and which would have to last for the whole year.

This multiplicity of interests, with its conflicting pulls, inevitably generates confusion. Some degree of stream-lining, and a narrowing down of interests, would appear necessary if more satisfying results are to be achieved. As the International Bank Mission has pointed out, there is too much unnecessary duplication of work between RIDA and the other government departments.[3] The absence of any clear idea of the direction towards which RIDA is working may be illustrated here. In 1951, it was stated that the Authority was to develop mainly into a marketing and processing organisation.[4] By 1954 when the few attempts at marketing and processing peasant produce had proved unsuccessful, interest in that direction flagged and shifted towards a safer objective. The Authority, it was declared, 'would be more and more concerned in the future with training in all its aspects . . .'[5]

There is also the added danger that because of the nature of its work, RIDA might be used for political ends, namely, the winning of votes in the rural areas. Since there is nothing in RIDA's constitution to prevent its staff becoming members of political parties, the possibility of manipulation and gerrymandering exists. This danger was realised, and in 1955 the Government 'took

1. *Straits Times*, 10th September, 1951; and *The Manchester Guardian*, 15th October, 1953.
2. *Federation of Malaya, Annual Report, 1954*, p.197.
3. *The Economic Development of Malaya*, pp.221-2.
4. *Straits Times*, 20th January, 1951.
5. *Federation of Malaya, Annual Report, 1954*, p.196.

steps to make the members, officers, and servants of RIDA politically impartial when they are engaged on RIDA business.'[1]

With its emphasis on self-help, and its insistence that the original impetus to development should come from the village level rather than from the top downwards, RIDA has sought to break the rural population away from the 'Government should do it' attitude. 'The Malays, in particular, have looked upon the Government as the sole source from which everything should be initiated and implemented to better their condition.'[2] It is unfortunate that before the end of its second year RIDA found it necessary to relax this principle of self-reliance 'in regard to some schemes'.[3]

It remains to be seen if RIDA will become more than a government department specially created to dole out funds at intervals for the benefit of a few villages. Yet the potentialities of such an organisation for raising the peasant living levels are great, once the Authority has established itself and has gained the experience, obtained the funds, and found the skilled personnel sufficient to place its work on solid foundations. Perhaps its greatest potentiality for success lies in the fact that its creation was an internal affair, and not the outcome of a western inspired plan. It has succeeded in drawing attention to the rural areas and to rural matters, both of which have hitherto been neglected. The measure of RIDA's effectiveness must, however, continue to depend on whether it is able to solve the outstanding problems of rural indebtedness, credit, and marketing, which are responsible for the diminution of peasant levels of income. Unless these anomalies are removed, it is difficult to see how material levels of living in the rural areas could be raised.

1. D.H. Horton, *Federation of Malaya, Weekly News Summary,* for the week ending 8th January 1955, pp.6-7.
2. *Fed. Leg. Co. Paper No. 10 of 1951,* p.B19.
3. *Fed. Leg. Co. Paper No. 35 of 1953,* p.4.

CHAPTER VIII

LAND TENURE PROBLEMS

SINCE MOST of the population in the tropical underdeveloped countries are agriculturalists and are tied to the soil, the relationship between these communities and the land is of fundamental importance. There are two sides to this relationship. The first concerns land as a supplier of human needs, raw materials, food and shelter (or land utilization). The second involves the relationships established amongst men which determine their varying rights in the use of land (or land tenure).

The raising of living standards pre-supposes increased production, but improvements in agricultural methods and techniques are often necessary before this goal can be attained. The prevention of soil erosion and the maintenance of soil fertility, the use of manures and fertilisers, the introduction of better crop varieties and the dissemination of practical information on tillage methods, crop varieties, and conservation practices are all basic to the development of peasant agriculture. To produce the large and regular surpluses needed for higher living levels, a change has to be made from the subsistence mode of existence to production for the market, with a corresponding change of techniques. A new equilibrium must therefore be established between the population and the land, and this can only be achieved through a system of tenure which permits the technical changes to be made.

The conditions under which land is held cannot by themselves contribute directly to the size of the rewards of agricultural production, but they '... can ensure that the net returns of production are divided proportionately to the contribution of capital, skill, and labour, and to the provision, upkeep and improvement of the needs of production, and that parties who do not make an effective contribution of one kind or another do not share in the profits. In this way a satisfactory tenure system can help to provide the rural family with a level of living which is the best possible under existing conditions of agricultural production.'[1] Conversely, an unsatisfactory tenure system may result in the farmer being deprived of the income which should accrue to him, and act as a deterrent to agricultural improvement, with consequential ill effects on the condition of the land, as well as on the farmer's level of living.

Agrarian structure in Asia is characterised by the prevalence of minutely-parcelled and fragmented holdings, high rentals, heavy indebtedness, high rural population density, labour-intensive cultivation and laborious methods of farming. Wherever these conditions obtain, the peasants have a very low standard of living.[2] In Malaya, most of the '... inequities and inadequacies of prevailing systems of agricultural marketing, credit and land tenure in Asia are to be found in greater or lesser degree among the small cultivators'.[3] The problems of marketing and credit were examined in the previous chapter. It is now intended to discuss those problems arising from defects in the system of land tenure in Malaya, and their effect upon peasant levels of living.

1. E.H. Jacoby, *Inter-Relationship between Agrarian Reform and Agricultural Development* (Rome, 1953), p.7.
2. U.N., *Land Reform*, p.48.
3. *The Economic Development of Malaya*, p.77.

PEASANT LAND TENURE IN MALAYA.

In Malaya, in historical times, the economic aspect of land—its role in production and exchange—was intimately bound up with, and influenced by, its place in the social and religious set-up of the Malays. Because there was an abundance of land in relation to population numbers, land as such had no saleable value. The only value it had was derived from the labour invested in clearing it from the jungle, and converting it into padi-fields or kampongs. Under the system of customary land tenure, a person created a proprietary right by selecting and appropriating a piece of forested land, clearing it and continuing to live on it. His right to the land was absolute as long as he remained in occupation of it, or in the case of planted fruit trees, for as long as the trees survived. The Malay term for uncleared land, or long-abandoned land which bore no trace of cultivation, was 'tanah mati' (dead land). Land that had been cleared for cultivation or for building, was referred to as 'tanah hidup' (live land). The latter could be of three kinds depending upon the use to which it was put: (1) 'tanah kampong', in which the land was planted with fruit or other kampong trees; (2) 'tanah sawah', in which the land was planted to wet-padi; and (3) 'tanah ladang' in which the land, usually slopes, was cultivated under dry-land crops. 'Tanah ladang', as the term suggests, was usually cleared for shifting cultivation, and the proprietary right existed only for as long as the land was under crops. But the proprietary rights to wet-padi and kampong land continued for three years after the land had been abandoned, after which time the weeds and pests which invaded the holding would have become a serious menace to neighbouring fields. The local chief could then confiscate the holding and let it to another cultivator.[1]

Monarchial government, introduced by Hindu rulers from India, modified the tenure system. For instance, the proprietary right created by the cultivator which remained absolute as long as he was in occupation of the land, could now only remain so provided he paid a proportion of the grain as tax to the 'raja' or chief. Again, all waste land, that is, abandoned land or land with no heirs, now belonged to the 'raja' who had the right to dispose of it as he wished. From this beginning there developed the doctrine that the 'raja' had supreme right to the land. The peasant retained only the usufruct, a form of possession which bore a distinct resemblance to that prevailing in tropical Africa, where customary law and practice gave the peasants a title to communal land which was usufructuary rather than absolute.[2] In Malaya, the rights of the 'raja' have survived to this day, for in all the nine Malay States the property in, and the control of, unalienated land is vested in the Ruler. Theoretically the peasant could not be evicted from the land unless he failed to pay the royal tithe or voluntarily abandoned the land.[3] In practice, however, the absolute power wielded by the 'rajas' did not permit anything like complete security of property rights, and the western concept of 'ownership of the soil' was unknown.[4] The farmer did not own the land, but merely possessed a permanent and inheritable right of occupation conditional upon continuous cultivation, payment of taxes and rendering of customary services to the 'raja'. Transfers of land therefore involved only transfers of that interest. The

1. W.E. Maxwell, *The Laws and Customs of the Malays with Reference to the Tenure of Land* (Singapore, 1885), pp.3-6; and Newbold, op. cit., Vol. 1, pp.160-1, and Vol. II, pp.254-5.
2. C.K. Meek, *Land Law and Custom in the Colonies* (Oxford, 1949), p.26.
3. W.E. Maxwell, op. cit., pp.15-18.
4. Ibid., pp.31-2. A similar situation prevailed in Indonesia; see K.J. Pelzer, 'Population and Land Utilization' in F.V. Field (ed.), *An Economic Survey of the Pacific Area* (Shanghai, 1941), pp.157-9.

price paid had no bearing on the value of the land itself, but was merely a recoupment of the outlay originally incurred in bringing it into use.[1] The Malay term for such transfers is 'pulang belanja' (literally: return of expenses). In a similar manner a Malay who wished to raise money by mortgaging his land sold only his proprietary right to the creditor ('jual janji'). Such a transaction differed from the English form of mortgage in that no property in the soil exchanged hands but only the proprietary right, and possession was actually given to the creditor. The debtor who wanted to remain on the land would have to pay rent in kind, or money, in lieu of interest which was forbidden by Muhammadan law.[2]

With the coming of British rule there was a gradual change in this customary form of tenure. Several influences were responsible for the change. In the first place, the *pax Britannica* enabled farmers to cultivate their land in safety wherever they wished. The settled conditions ushered in for the first time also encouraged peasants to cultivate their land more carefully, with the certainty that any profits accruing therefrom would not be seized. The introduction of the money economy, and of commercial crops, together with the increased participation of the peasants in market production, weakened the bases of many of the local institutions, and acted as a compelling force towards the progressive individualization of holdings. Most of the commercial or revenue crops are tree crops, which take several years to mature, and could be planted only where there is sufficient security of tenure. As Lord Hailey has said 'A . . . clearly defined change occurs when the cultivation of marketable crops takes the place of purely subsistence production. Boundaries become more clearly recognized; the units occupying the land tend to be narrowed down to the small family or even the individual; the conception of ownership begins to replace that of usufruct.'[3] The idea of individual ownership was more easily acceptable in Malaya than in, say, tropical Africa, because of the sedentary nature of Malay agriculture, with the continuous cultivation of the same piece of land under wet-padi or permanent tree crops.[4]

British administration made its impact on the land tenure system in two ways. There was the influence of English law with its insistence on individual rights, which was also extended to land and land laws. The second influence was derived from the need to obtain revenue. A heavy tax was imposed on Malay agricultural land, and for purposes of collection a form of registration of the persons in occupation was necessary, so that the process towards individual ownership was accelerated. A more substantial source of revenue was derived from the mines and plantations. Vacant land was alienated for mining and planting, but it was necessary to be able to promise satisfactory titles, without which foreign capital would not be attracted to the country.

In the Straits Settlements, which were the first to come under British rule, the land registration procedure that had been followed in India was introduced without regard to differences in local conditions. Each landholder depended for his title upon the written grant, or licence, or merely upon the verbal permission of the Land Officer. An extremely complex system of registration of deeds was

1. Winstedt, *The Malays: A Cultural History*, p.110.
2. W.F.N. Bridges, *Surveys for Title in the Federated Malay States* (Kuala Lumpur, 1930), pp.48-50.
3. Meek, op. cit., p.xii.
4. Among the Tanala tribe of Madagascar, for example, the introduction of wet-rice cultivation with its concomitant of continuous cultivation of the same tract of land led indirectly to individual ownership of land. U.N.E.S.C.O., *Cultural Patterns and Technical Change*, p.201.

set up, with imperfect and sometimes no marking of boundaries.[1] The general confusion arising therefrom led to the introduction of an alternative method of land registration in the other Malay States, namely, the Torrens system. A certificate of title was issued under this system which established an indisputable right of ownership to the land thus registered. The sale and mortgaging of land was also made easy.[2]

The original intention of the Commissioner of Lands, as put forward in the Selangor Land Regulation of 1891, was to issue two forms of titles. One was based on the Torrens system which provided for the needs of the European and commercial interests, and involved a careful survey and demarcation of boundaries. The other was based on the registration of customary native land in which any person who had his name on the register obtained a permanent right of use and occupancy of his land. Such a right did not include the right to lease or charge the land, and the title fell far short of the western concept of ownership, but it had the advantage of not requiring the accurate and expensive survey necessary in the other type of title. The subsequent development of revenue crops, the increasing extent to which the Malays took to growing them in their holdings, together with the fact that the native system of tenure existed side by side with the Torrens system, tended to produce an assimilation of the customary title by that of the registered one. The change over was in fact demanded by the Malays themselves, who were suspicious of the distinction between their own titles and those of the Europeans and Chinese.[3] Some of them discovered during the early years of the rubber boom that access to registered and transferable titles enabled them to sell and to speculate in land, and a few reaped spectacular profits from land transactions.[4]

The process of transfer began with the introduction of the Mukim register in 1897, and by about 1930 there was no appreciable difference between customary and registered titles, except the minor technicality that in the case of grants the form of registration was metropolitan while in the case of native entries, it was local. The peasant now became by law the owner of the land he cultivated, with power to sell it, obtain loans with it and transmit it after death with the minimum degree of formality and expense.[5] The State, however, retained the right, under the 1926 Federated Malay States Land Code, to forfeit any piece of land for which the owner failed to pay the annual quit rent, or broke any special condition of his title, such as, by failing to cultivate continuously and in a proper manner one-half of the area covered by the title for three consecutive years, or, in the case of padi land, three-quarters of the area for two consecutive years.[6] Peasant land in Penang and Province Wellesley and Malacca was held under slightly different conditions. In Penang and Province Wellesley land was held by grant or lease from the Crown, and was fully transferable. In Malacca smallholdings cultivated by Malays were held under customary tenure. Every landholder had

1. W.E. Maxwell, *Straits Settlements, Present and Future Land Systems* (Rangoon, 1883), pp.1-13.
2. Bridges, op. cit., pp.10-11.
3. Gullick, 'The Negri Sembilan Economy in the Eighteen-Nineties', p.42.
4. The *Straits Times,* 25th February, 1956.
5. Bridges, op. cit., p.13.
6. Further details on land tenure in Malaya can be found in J.V. Cowgill, 'System of Land Tenure in the Federated Malay States', *M.A.J.,* Vol. XVI, No. 5, 1928, pp.181-93; C.W. Harrison, *Land Laws and Land Administration in the Federated Malay States,* (Singapore, 1923); and N.H. Jarrett, 'Land Tenure in Malaya', *Eastern World,* Vol. V, No. 384, 1951, pp.9-10.

the right to transfer his land by sale or mortgage, but only to another person who was also a customary landholder, or who had qualified to become one, namely, a Malay domiciled in Malacca, or any other person certified by the Resident Councillor of Malacca as qualified to hold customary land.[1]

In Malaya today, the Malay peasant holds land under individual tenure with full ownership rights, including the right to dispose of it as he wishes. The process of transition from customary to individual tenure was facilitated by the sedentary nature of the Malay agricultural occupation of wet-padi cultivation, whereby the same piece of land remains under the same crop for long periods of time. Also when revenue tree-crops, such as rubber, were introduced, the long productive life of the trees further strengthened the ties that bound the farmer to the same piece of land, and hastened the process towards full ownership.

The position in Malaya may be contrasted with that in tropical Africa today, where most of the indigenous peoples are still in the subsistence stage of agriculture based on shifting cultivation. The main characteristic of the African tenure system is that land is held on a kinship or local group basis, or both, the title having a communal character and bearing usufructuary rather than absolute right.[2] The kinship basis of landholding makes for social stability, but the absence of individual proprietary rights prevents the raising of money on land, and does not provide the incentive to improve conditions on any piece of land. Both of these are impediments to economic development. The land tenure problems in tropical Africa arise from the need to make the change from communal tenure to other forms of tenure, which would both foster economic development and prevent soil degradation. But this change cannot be achieved without widespread social disturbance, as well as changes in the system of agriculture. There are conflicting views on whether social stability and the existing system of tenure should be preserved, or whether the need for economic development is greater, and therefore new patterns of landholding should be initiated which would best enable such development to take place. This conflict is exemplified on the one hand by the view put forward during the International African Conference on Indigenous African Rural Economy, that '... any development of new patterns of agriculture and rural economy should as far as possible be based on indigenous systems of land tenure',[3] and on the other hand by the conclusion of the 1953-55 East Africa Royal Commission, that the '... approach on a tribal basis to questions of land tenure and land-use is incompatible with the development of a modern economy.'[4] The Commission went on to recommend that 'Policy concerning the tenure and disposition of land should aim at the individualization of land ownership and mobility in the transfer of land which ... will enable access to land for economic use.'[5] Tribal customs, which restrict the use of land as a basis for credit, prevent the growth of a class of African capitalists without which the indigenous economy will not expand nor will living standards improve. Until tribal land becomes freely exchangeable, and is available for unrestricted sale and individual ownership, the

1. Meek, op. cit., pp.35-6.
2. Ibid., pp.26-7; also Liversage, op. cit., pp.2-3.
3. *International African Conference on Indigenous Rural Economy, 17th-24th November, 1949, Final Report* (Jos, Nigeria, not dated), p.70. Also, U.N. *Progress in Land Reform, Analysis of Replies by Governments to a United Nations Questionnaire* (New York, 1954), pp.33-6.
4. *East Africa Royal Commission 1953 to 1955 Report*, p.397.
5. Ibid., p.428..

fullest use cannot be made of it, nor the change made from a subsistence to a modern market economy.[1]

Thus whilst the problem in Africa derives basically from the need to make the transition from communal to individual tenure, in Malaya the transition has already been completed (except in Malacca). The problems of rural development originating from defects in the tenure system in Malaya are thus associated with a system of individual landholding rather than those associated with communal tenure. The rest of the chapter will be devoted to an analysis of these problems.

PEASANT LAND TENURE AND CREDIT PROBLEMS.

Having gained unassailable ownership rights and security of tenure, the Malay peasant may now adopt a more positive attitude towards his land. He is provided with the incentive to improve the land by further investments in labour or capital. But, because of his poverty, the only method by which he could raise the necessary capital for these improvements is to pledge his land as security for a loan. In the absence of government credit institutions and effective co-operatives, the professional money-lender becomes the sole source from which such loans may be obtained. It is inevitable that, in time to come, some of the loans would be unredeemed, and land would then begin to pass into non-indigenous hands. What makes the situation even more serious is the improvident use of land for raising credit for purposes not connected with agriculture, but rather for social occasions.

The way is now open for the accumulation of large holdings through mortgage foreclosures, and for the growth of a landlord class often unable to use the land to good purpose, and, with it, the growth of a landless tenant class with the dangers of rack-renting and absentee landlordism.

Thus as early as 1911 the Government of Perak had commented upon the increasing sale of land by Malays to non-Malays. It forecasted that 'the ultimate destruction of the Malay landowner would seem to be a matter of years.'[2] It was also stated, in the same year in the Federal Council, that over 2,500 separate Malay holdings were sold in the previous eighteen months, and many of these were ancestral land. The Malay who sold his ancestral patch did not take up new land elsewhere but became a landless wanderer. The dangers of conferring exclusive individual rights, with power to encumber or transfer lands, upon a peasantry unversed in the intricacies of a money economy quickly became apparent, and the Government introduced restrictive legislation which was intended to protect the Malay lands from falling into the hands of the immigrant population. Thus in 1913, the Federated Malay States Malay Reservation Enactment was passed, forbidding the transfer or lease of land within a Reservation from a Malay to a non-Malay.

The effect of this legislation was to depreciate the value of land within a Reservation as a basis for credit. It was not surprising, in consequence, that the

1. Ibid., Chap. 23. See editorials on the Report in *The Times*, 10th June, 1955, and 2nd July, 1955. The Governors of Kenya, Uganda and Tanganyika have since accepted the Commission's recommendation that there should be a move towards the individualization of African land tenure: see *Despatches from the Governors of Kenya, Uganda and Tanganyika and from the Administrator, East Africa High Commission, commenting on the East Africa Royal Commission 1953 to 1955 Report* (H.M.S.O. 1956), pp.93-7, 149-52 and 160-1. Also *Commentary on the Despatches from the Governors of Kenya, Uganda, and Tanganyika* (H.M.S.O., 1956), pp.3-4; and the editorial in *The Times British Colonies Review*, No. 23, 3rd Quarter, 1956, p.2.
2. *Annual Report on the Social and Economic Progress of the People of Perak, 1911* (Kuala Lumpur, 1912), p.11.

official reports began to comment upon the lack of demand by Malays for land in the Reservations.[1] In 1920 the Federated Malay States Government had to admit that the Malays preferred to settle on land outside the Reservations because of its saleability.[2] The Enactment did not prevent those living in the Reservations from pledging their land as security on loans, and the Chinese and Indian creditors evaded the law by making use of Malay nominees to hold foreclosed land on their behalf. At the end of 1930 official estimates put the amount of debt secured by charge and registered lien on land in the Reservations at nearly $6,000,000, almost all of which was owed to Chettiars or Chinese money-lenders. The unregistered debts came to an additional $1,800,000. Of the 6,300,000 acres of reserved land in the Federated Malay States between 2.5 and 4.6 per cent in each State was under charge. The Resident in Perak estimated that the Malay peasants in his State alone were in debt to a sum of $25,000,000. A large percentage of the loans were incurred for non-productive expenditure.[3]

In order to prevent further deterioration of the situation, the Federated Malay States Government passed an amendment to the Malay Reservation Enactment in 1933 which stopped the disposal of reserved land by charge, lease or any other means to non-Malays, and decreed that such land could not be taken in discharge of a debt, thus ensuring at least nominal Malay ownership. Similar legislation was passed in the other States. The Committee reporting on this question also recommended that in no State in the Federated Malay States should the ratio between the cultivable area in the Reservations and the total cultivable area in the State be allowed to fall below 60 per cent. The recommendation was accepted.[4]

The creation of the Malay Reservations was considered necessary for protecting Malay lands from falling into non-Malay hands. From the land-use point of view, the existence of large Reserves (Fig. 31) in sparsely peopled areas would

Fig. 31. Malay Reservations in Malaya, 1954. Source: *The Economic Development of Malaya*, Map 7.

1. See for example, *Annual Report of the Social and Economic Progress of the People of Perak, 1916* (Kuala Lumpur, 1917), p.3.
2. *Report for 1920 on the Federated Malay States* (H.M.S.O., 1921), p.3.
3. *Proceedings of the Federal Council of the Federated Malay States, 1931* (Kuala Lumpur, 1932), pp.B16-19, B37. *Proceedings of the Federal Council of the Federated Malay States, 1933* (Kuala Lumpur, 1934) pp. B132-8, B159-60. Also *Third Inter-Departmental Agricultural Conference, Report of Proceedings*, pp.80-1, 84 and 88.
4. R. Emerson, *Malaysia: A Study in Direct and Indirect Rule* (New York, 1937), p.479.

impede development because of (1) the reluctance of the Malays to move into these areas, (2) the limited Malay capital resources available, and (3) the natural reluctance of non-Malays to invest in land which they cannot own.[1] From the point of view of the Malay peasants, it is doubtful if the restrictions placed on their land will cure the tendency to improvident spending. They do make the raising of loans more difficult, but, on the other hand, there is nothing to deter a non-Malay creditor from assuming *de facto* ownership if he thought it worth his while. In this case he would tend to charge a still higher rate of interest, because of the greater risks involved and the limited transferability of the land. Borrowing and lending, in brief, becomes a riskier business. But the most serious disadvantage resulting from the rigidity of the Reservations Enactment is that, while intending to restrain thriftlessness, it also deprives the Malay smallholders of access to the credit required for productive purposes. No farming community can live entirely without credit, and, in the absence of adequate public and co-operative credit sources, the peasant who is industrious now finds that he is unable to raise the capital for agricultural improvement from what had in the past been his main avenue—his land. The Malays accordingly 'objected to the curtailment of their opportunities for raising credit on their holdings.'[2]

The Federal Government in an effort to remedy the shortage of rural credit later passed an amendment to the Enactment, whereby land within the Reservations could be mortgaged to certain public and quasi-public institutions, namely, the Chief Secretary, the RIDA, the Housing Trust, the Rubber Industry (Replanting) Board and the Federal and Colonial Building Society.[3] The difficulty here is to be able to distinguish between loans required for productive expenditure and those required for non-productive expenditure. As none of the above mentioned institutions are specifically concerned with land questions, or the mortgage of land, the alternatives are either to grant loans indiscriminately to all who own land and are able to pledge it as security, or to make special enquires on each separate potential mortgagee in order to obtain details of the reasons for his loan. In the former case the institutions are likely to find themselves dispossessing a large number of smallholders of their land because of non-payment of loans, a step which they are always reluctant to take, or else they must write off these unpaid loans as bad debts, which they cannot afford to do. In the case of the latter alternative, the lack of the necessary machinery and experience to conduct the investigations render them both time-consuming and expensive. The peasants themselves may not be willing to submit to a close examination of their affairs or to wait a long time for their loans to be approved.

Because of the restrictions on land convertibility, peasant titles of ownership have lost much of their value as a means of raising agricultural credit for expanding the area under cultivation, or for agricultural improvement. At present no effective substitute credit sources are available. The root cause is the peasant's tendency to borrow for extravagant expenditure, and in so far as it will be necessary to protect him against losing his main means of existence—his land—so long will restrictions appear to be needed on land transfer ability. But the consequential locking up of Malay land in the Reservations will continue to be a handicap to agricultural production.

1. *The Economic Development of Malaya,* p.313.
2. Meek, op. cit., p.56.
3. *The Economic Development of Malaya,* p.312.

INSECURITY OF TENURE AMONGST PADI-PLANTERS

It is often argued that the ideal specific for ensuring the best and most contented farmers is individual ownership of land with security of tenure. Security of tenure, while desirable, is no protection against the normal risks of climate, season, or market, nor is it a safeguard against the inefficient farmer depleting the soil. The farmer cannot be prevented from bad agricultural practices simply because he is free to do what he wishes with his land. But though security of tenure cannot guarantee sound conservation of land resources or increase agricultural production, whenever the form of tenure is precarious and insecure it will often directly cause evil consequences due to the lack of incentive to maintain or improve soil fertility. Where the tenure is very insecure, the tenant usually has but one aim—to get the most out of his land regardless of the effect on the soil. In many cases the tenant with an insecure tenure has also to pay high rents because of the competitive demand for land. Insecurity of tenure affects the peasant's standard of living in two ways. In the first place he will have little incentive to increase his output, because a large proportion of any increase will go to the landlord who has not contributed anything to its cost. Secondly, the high rents in cash, or in kind, leave the peasant with little more than bare subsistence, and nothing for savings or investment. In a bad year he gets deeply into debt. Also, the tenant who does not know whether he is to be evicted soon or not cannot be expected to plant fruit trees, and his diet is reduced to the simplest available foods and is usually deficient. Nor can other permanent cash-crops such as rubber, coconuts, cocoa and oil-palm, which take several years to mature, be grown when the peasant stays for only a short period on the same piece of land.

The abuses associated with rackrenting and extreme insecurity of tenure, both features of the Asian rural landscape, are present in Malaya only in those areas where pressure of population on cultivable land has become heavy, and where there is also lack of alternative employment opportunities which could otherwise absorb the superfluous agricultural population. The reluctance of the Malay peasants to move away from their customary villages, and to take up wage-earning occupations elsewhere, has contributed towards the creation of localised areas of congestion and land hunger. In earlier days such a congestion could have been easily relieved by opening up and settling on adjacent land, but since the turn of the century the large population increases have taken up most of the conveniently available cultivable land. To some extent these increases have been absorbed into the new padi-irrigation schemes, and into rubber cultivation, but in those States where there has been a fairly long heritage of intensive food-crop cultivation (as in the padi-growing regions of Kelantan, Perlis, Kedah, Penang and Province Wellesley, Krian and Malacca) a state of saturation has been, or is being, reached. Since as early as 1908, for instance, there has been an annual exodus of peasants from Penang and Province Wellesley into the Krian irrigation area for the padi-planting season.[1] Acute land hunger in Kelantan has resulted in excessive sub-division of land with individual plots frequently less than a quarter of an acre in size.[2] Localised but severe land hunger also exists amongst rubber-growing peasants, especially in the long-settled areas of Negri Sembilan, Malacca, parts of Johore,

1. Wilkinson, *'Life and Customs, Pt. I. The Incidents of Malay Life'*, pp.39-40. See also *Report of the Rice Cultivation Committee, Vol. II*, p.23.
2. Ashby, 'Wet Padi Mechanical Cultivation Experiments in Kelantan, Season 1948-49', p.152; also Dobby, 'The Kelantan Delta', pp.251-2.

Ulu Selangor, and the Kuala Muda District of Kedah.[1] Burgess and Alang Musa in an enquiry into the affairs of fifty rubber smallholders in Malacca found that 18 per cent of them owned no land of any sort, whilst 54 per cent of them owned up to 1.5 acres of land, an area too small to provide for a family throughout the year.[2]

The problems of landless peasants, high rents, and insecurity of tenure have now become pervading enough in parts of the north-western coastal plain to draw public and governmental attention to them. The 1953 Rice Production Committee estimated that about 75 per cent of the padi land in Province Wellesley, 70 per cent in Kedah and 50 per cent in Krian were cultivated by tenant farmers. Elsewhere the proportion was not so high. In Perlis about 10 per cent of the total padi land was cultivated under lease. In Kelantan a certain amount of land was rented. No information was available for the other States.[3] In 1955, surveys of the tenancy situation in sample padi areas in Province Wellesley, Kedah and Krian, confirmed the estimates made by the Rice Production Committee.[4]

Tenant-farming as such is not an economic or a social evil as long as the tenant is reasonably secure in his tenure and does not have to pay excessive rents. In pre-war years tenancies were normally granted on a year to year basis, and the tenant was fairly sure of having his tenancy renewed as long as he cultivated the land with care and paid the usual rent. Tenancies were not registered but made through verbal agreements. The landlord could not easily evict a tenant who broke no regulations, because local opinion would be against such a move. Controversies between landlord and tenant were settled by a council consisting of the headmen, village elders and religious teachers, whose decisions were respected by both parties. Rents were paid after the harvest, usually in kind and at the rate of one-third of the crop.[5] Though the fairly high rent clearly involved a substantial diminution of the peasant's net income, in all other respects he was not much worse off than the owner cultivator.

The established pattern of tenancy and rents has changed considerably since the war. The factors responsible for the change are the increasing pressure of demand for land by a rapidly growing population, the higher market values for padi land, and the diminished force with which tradition is now observed, especially in western Malaya. All these have strengthened the position of the landlords, and because of it, and because of the competition amongst tenants who cannot or are not willing to find alternative employment, rents have risen to high levels in some areas. In Kedah the 1949 rent per relong (0.7 acre) of land was eighty gantangs of padi plus $60 to $65 in cash. In 1952 the cash rent increased to between $120 and $130 per relong.[6] Against this may be contrasted the $1 maximum rent per 'relong' charged by the State for leased land. Investigations by the International Bank Mission revealed rent increases of 30 to 100 per cent in some

1. Mudie and Others, op cit., p.33; and Bauer, *Report on a Visit to the Rubber Growing Smallholdings of Malaya,* pp.38-9.
2. *A Report on the State of Health, the Diet and the Economic Conditions of Groups of People in the Lower Income Levels in Malaya,* Table XIX, p.47.
3. *Report of the Rice Production Committee, 1953,* pp.45, 76, 88; see also *Final Report of the Rice Committee,* p.10.
4. E.H.G. Dobby and Others, 'Padi Landscapes of Malaya', *M.J.T.G.,* Vol. 6, 1955, pp.30, 54, 78, and Plates 31-3 and 55-7.
5. *Report of the Rice Production Committee, 1953,* p.45.
6. Ibid., p.82.

districts of northern Kedah and Province Wellesley.[1] In Mukim Dulang of Kedah the Chettiar landlords charged the highest rents, and followed the practice of increasing rents by two gantangs of padi every year.[2]

Rents in pre-war days were usually paid in kind, but since the war there has been a growing tendency to demand cash, or cash plus the traditional payment in kind.[3] Landlords also demand that rent be paid in advance of the growing season, or else be of an amount fixed in advance.

The exorbitant rents that tenants have now to pay in the densely settled padi-growing areas lead directly to a sharp decrease in their incomes and hence to their living standards, while the need to pay cash rental in advance places an additional burden of price risks upon their shoulders. In addition, both high rents and advance payments force many tenants to borrow in order to meet the requirements of the landlords. The shopkeeper is often the sole recourse. The cash is loaned on the 'padi kuncha' system, and the high rates of interest may be viewed as rent increases in a concealed form.

Another concealed form of rent increase is the demand by the landlords for 'tea-money' from prospective tenants. This practice, a legacy of the war years, has spread throughout Malaya. It takes the form of a premium. Prospective tenants are requested to pay a sum in cash, over and above the normal rent, as a condition to their obtaining their leases, while existing tenants are also called upon to pay the sum as a condition to the renewal of their leases. In 1952, for example, the 'tea-money' for every seven acres of padi land in Kedah was $200.[4] This attempt to cash in on the growing shortage of good padi land '... represents a form of blackmail, since no justification for it can be found in any extra service performed by the landlord.'[5] The tenant therefore lives under the most insecure conditions, for he has to face the risks of being evicted at the end of every season. Standards of cultivation are bound to deteriorate as each tenant tries to wrest the most out of the soil. Manuring, the benefits of which last some three years, will not be undertaken by a peasant who is not sure of remaining on the holding for more than a short time.

The Federal Government has now introduced legislation which seeks to provide the tenant with a reasonable degree of security of tenure, and to limit the maximum amount of rent for padi land. Under the new law the tenant has the option of renewing his lease at the end of each year, and the maximum rent is limited to one-third of the crop, to be paid in kind and not in cash. 'Tea-money' or any other form of extra payment is made illegal.[6] Tenancy agreements are to be made in writing instead of verbally, and must be signed by both landlord and tenant.[7]

While these laws can to some extent correct the worst excesses of the landlord-tenant situation, they do not remove the causes which are derived mainly from the growth of a landless agricultural population, a shortage of suitable land, the lack of alternative employment as well as the reluctance of farmers to seek other occupations. There are also loopholes for evading the laws. There is nothing to prevent landlords from demanding high rents in private while comply-

1. *The Economic Development of Malaya,* p.318.
2. Dobby and Others, op. cit., p.54.
3. Ibid., p.30, 54, 78.
4. *Report of the Rice Production Committee,* p.82; also the *Malayan Bulletin,* Vol. IX, No. 98, 1955, p.4.
5. *Report of the Rice Production Committee, 1953,* p.46.
6. *The Straits Echo,* 22nd March 1955; and *Straits Times* 30th March, 1955.
7. *Straits Echo,* 18th September, 1955.

ing outwardly with the regulations. The tenant is often unable to protest because he is already in debt to the landlord. An indication of the ineffectualness of the legislation is the very small number of written tenancy agreements that were signed in Kedah in 1955.[1]

INSECURITY OF TENURE AMONGST CHINESE PEASANTS.

The origins of the squatter population in Malaya were discussed earlier. For several reasons the squatter had no title to the land on which he settled. A great number of them were unable to obtain titles because they were on reserved land, such as, Malay Reservations, Forest Reserves, or land already alienated for mining and other purposes. Others could not afford to pay for the cost of the title-survey; those who could were given Temporary Occupation Licences (T.O.Ls.) instead of more permanent titles, either because the Land Office could not undertake detailed surveys due to the backlog in title registration, or because the land was earmarked for other proposes. The T.O.Ls. were issued for one year in the first place, and would be renewed from year to year if the land was not required in the meantime, but the licencee had no right of transfer, or of compensation if the licence was not renewed. The total area so occupied in Malaya in 1949 was estimated at 70,000 acres.[2]

There was absolutely no security of tenure for the squatters. The Chinese market-gardeners living on the urban fringes were frequently summarily evicted to make way for urban development, or for sanitary reasons.[3] No compensation was allowed, so that the labour, money and time that had been expended in converting a piece of waste or derelict land into a flourishing market-garden were totally lost. It was inevitable that the squatters should come to regard the land as an expendable asset, from which the utmost must be squeezed out.

During the first years after the war the severe food shortage led the British Military Administration to issue two-year free permits to squatters, and others, who were willing to cultivate temporary food-crops as a relief measure.[4] Official sanction was thus given to what had hitherto been an illegal or near illegal practice. The move did in fact serve to augment the food supply. In the rural areas dry-padi was grown, and near the towns the squatters depended mainly upon green vegetables, pigs and poultry. But in some cases the squatters concentrated instead on cultivating the more lucrative catch-crops, such as, tapioca and tobacco in Kedah and Perak, bananas on the slopes of the foothills of Negri Sembilan, and pineapples in Johore. Although State laws in Kedah prohibited the growing of tapioca as a sole crop, and in Johore the law forbade the growing of pineapples on upland soils, there was no supervision, and the squatters disregarded the laws with impunity. Finding T.O.Ls. easily obtainable and spare land in plenty, they adopted a purely superficial attitude towards the land, cultivating it for its immediate returns, and consequently causing widespread soil degradation.[5]

What useful functions they performed during the critical period immediately after the war were soon nullified by the damage they did to extensive areas of once-forested land. With the declaration of the state of Emergency in Malaya in 1948 they became a vital factor in the local war-effort, for, living as they did in

1. Ibid.
2. *Report on the Squatter Problem,* pp. C534-5.
3. *Third Inter-Departmental Agricultural Conference, Report of Proceedings,* pp.43-4, 98.
4. Wyatt-Smith, op. cit., pp.24-6.
5. J. Wyatt-Smith, 'Forestry, Agricultural Settlements and Land Planning', *The Malayan Forester,* Vol. XIV, 1951, pp.206-8.

remote rural areas, the squatters formed an important source of information, supplies and recruits to the terrorists. Following the report and recommendations of the Squatter Committee,[1] the squatter population was moved and resettled in compact, enclosed villages as a security measure. Resettlement started in 1950 and some 550 'new villages' were created, with a total population of about 570,000, mainly Chinese, but also with some Malays and Indians.[2] The necessity for speed, and the primary consideration for security, resulted in some of the new villages being badly sited from the point of view of the squatters' economic requirements. Some farmers found themselves so far removed from their farms that they had to abandon them. Early during the resettlement operations, an open type of new village was experimented with, whereby each farming family lived on its own plot of land with the entire area surrounded by barbed wire. Such an arrangement was popular with the Chinese who could then work on their land even after curfew hours. However, from the security viewpoint, the extended perimeter was a disadvantage as it was difficult to patrol, and to prevent contact between squatter and terrorist. It was therefore decided to abandon this type of new village. In all agricultural new villages subsequently established the farmer was often obliged to walk a mile or more to his farm, and he was not able to work on his land after curfew hours. At the same time he was compelled to divide his farming into two parts: that connected with crop cultivation which was carried out on the farm itself, and that connected with pig-rearing which had to be performed in, or near, his house. He then had to transport the pig fodder from his farm, and the pig manure to the land every day, a laborious business and one that did not make for efficiency. Considerable damage too, was done to the crops by pests at night.[3] These problems are still present in the new villages today.

Resettlement, however, gave an opportunity to the Government to eliminate the extreme insecurity of tenure characteristic of squatter occupation. Because of the great variations in land administration in the different States, the titles that are being offered to the resettled population engaged in agriculture vary as regards their terms. In Johore twenty-one year leases are offered. In Kedah, where titles to agricultural land are normally granted in perpetuity to Malays, the resettled persons are being offered thirty year leases for all types of land, and are charged $5 per relong (0.7 acre) as against the maximum of $1 per relong for first class padi land paid by Malay planters. A similar situation prevails in Selangor. In Penang the leases are for thirty-three years, and in Malacca the thirty-year leases can be renewed for a further thirty years.[4] All these offers are, nevertheless, considerably less favourable than the terms given to Malay peasants. This fact, coupled with the other disadvantages of farming in new villages, is responsible for the poor response shown by the squatters. In 1953, for example, a total of

1. See *Report on the Squatter Problem;* and *Fed. Leg. Co. Paper No. 14 of 1950* (Kuala Lumpur, 1954).
2. For more details on resettlement in Malaya, see *Resettlement and the Development of New Villages in the Federation of Malaya, 1952* (Kuala Lumpur, 1954); J. K. King, 'Malaya's Resettlement Problem', *Far Eastern Survey,* Vol. XXIII, No. 3, 1954, pp.33-40; C.E. Pritchard, 'Chinese Squatter Resettlement', *British Malaya,* Vol. XXV, No. 12, 1951, pp.215-16; E.H.G. Dobby, 'Recent Settlement Changes in South Malaya', *M.J.T.C.,* Vol. I, 1953, pp.1-8; and Ooi Jin-bee, op. cit., pp.49-56.
3. Wyatt-Smith, 'Forestry, Agricultural Settlement and Land Planting,' pp.208-9.
4. *The Economic Development of Malaya,* p.321; also *The Malayan Bulletin,* Vol. VI, No. 69, 1952, para. 377; *The Times,* 30th May, 1950;*Straits Echo,* 12th April, 1955.

8,151 applications for land were received from the resettled people throughout Malaya; of these 4,198 were approved and 124 refused approval.[1] The other reasons for the disappointingly few applications for land were that: the land offered was unsuitable for agriculture; the resettled persons disliked living in a village away from their farms; most farmers were satisfied with a T.O.L. which is less costly than a surveyed title; leasehold did not appeal to those accustomed to ancestral land in China; and finally, some had a feeling of political insecurity.[2]

Yet it is vital that the Chinese peasant farmer should be given greater security of tenure, for not only would it go a long way towards providing him with a chance to adopt a more positive attitude towards the land and the soil, and encourage him to invest in its improvement, but it would also have far-reaching social and political significance in exerting a stabilizing influence on that section of the rural population that has hitherto been recalcitrant.

THE SUBDIVISION AND FRAGMENTATION OF MALAY PEASANT LAND.

The division of agricultural land into minute parcels is usually associated with a congested rural population. It is also brought about by certain social customs and inheritance laws. At the same time the land may also be excessively fragmented so that a single holding may be composed of several parcels of land scattered over a wide area. This has happened in the older and more densely populated countries of Asia.

The size of a holding which can provide minimum sustenance cannot be assessed without taking into account the soil fertility, the rainfall, the intensity of cultivation and the types of crops. Nevertheless, the process of physical subdivision, if continued indefinitely, must necessarily lead to a stage when the unit holding cannot by itself yield enough to support the peasant and his family. At a certain stage the reduction in size may encourage a more intensive form of cultivation, but beyond that the law of diminishing returns begins to operate, and no amount of extra labour, or capital, will succeed in pushing production upwards. That stage has been reached in a large number of tropical countries.[3] The problem of uneconomic holdings is particularly acute in many parts of Asia.[4] The high rates of population increase, the lack of cultivable land and of alternative employment—all contribute towards a progressive deterioration of the situation.

Excessive fragmentation of land has many deleterious effects on farming. The dispersal of fields entails extra expense and effort in moving seeds, implements, animals and workers from one plot to another. 'Fragmentation leads to uneconomic holdings, concealed unemployment, increased indebtedness, reduced productivity of the land, the abandonment of very small plots which become breeding grounds for pests and, in general, has a disintegrating effect on an agricultural community.'[5] Efforts to improve conditions and farming methods on any piece of land are unnecessarily held up, because such improvements require the close co-operation of many individual farmers. They become still more difficult when radical changes, such as soil conservation measures, mechanization, and major drainage and irriga-

1. *Proceedings of the Fed. Leg. Co., March, 1953 - Janury, 1954,* pp.47-8; no information is available on the remainder of the applications; presumably they had not been considered by the Land Offices up to then.
2. *The Economic Development of Malaya,* p.321.
3. U.N., *Land Reform,* pp.6-7.
4. U.N., *Progress in Land Reform,* pp.182-5; also Jacoby, *Inter-Relationship between Agrarian Reform and Agricultural Development,* p.21.
5. *The Economic Development of Malaya,* p.314.

tion schemes are projected, for then re-organisation of the farms, and perhaps changes in ownership become necessary.[1]

Subdivision and fragmentation of holdings are most frequent where the laws of inheritance and succession demand the splitting up of land, as with Islamic laws of inheritance. In Malaya, as in most Muslim countries, a mixture of customary and Muslim law prevails,[2] though the laws of inheritance in the northern Malay States are now based exclusively on Muhammadan tenets.[3] Muhammadan law requires that a man shall receive double a woman's share when the land is cultivated by their joint labour. But since in the cultivation of wet-padi the wife's share of the labour is considerable, the customary law of Perak, Selangor, Pahang, Trengganu and of the other Malay States lays down that the share of the widow, on the husband's death, shall not be one-third but rather a half. The other half is divided according to Muslim rule among the children.[4]

The Malay laws of inheritance, which make no distinction between real and personal property, thus require that the property be split up among the co-owners into so many shares, and this often leads to the physical subdivision of the land itself. It may happen that, because of the multiplicity of co-owners, the parcels of land when subdivided are individually extremely small.[5]

Though Muslim law does not require that the land must be physically subdivided, the right to such subdivision exists. Any co-owner can therefore insist on partition. He can only be prevented through the intervention of the Collector of Land Revenue, acting at the request of another of the parties concerned.

Land registers show extensive fragmentation to be common in many parts of Malaya, although there is lack of information on the extent to which physical partition has been carried out. In Negri Sembilan many holdings are so small after partition that they are uneconomic to cultivate, and yields are low. Partition here has been by agreement rather than by survey, but the practical effect has been the same.[6] As would be expected, subdivision and fragmentation have proceeded furthest in the older settled areas, where it has been estimated that subdivision has reduced the size of an average smallholding to well below three acres, an area too small to provide a family with a reasonable standard of living.[7] In Penang where padi has long been grown, the land is extremely fragmented. In the Balik Pulau district, for example, 186 acres of padi land were divided amongst 140 separate owners, and the average size of each holding was only 1.33 acres.[8]

A survey in Krian illustrates the degree of subdivision and fragmentation that can occur in the course of two generations—from 1900 to 1954. The Tanjong Piandang 'mukim' consisted of 9,960 acres of cultivated land, 2 per cent of which was kampong land and the rest padi land. Eighty-nine per cent of the land titles were taken out in 1900 and the other 11 per cent between 1938 and 1939. The

1. These and related problems are discussed in greater detail by Sir Bernard O. Binns, *The Consolidation of Fragmented Agricultural Holdings* (Washington, 1950), pp.15-17.
2. Meek, op. cit., p.241.
3. Winstedt, *The Malays: A Cultural History*, p.115.
4. Maxwell, *The Law and Customs of the Malays*, pp.50-4; R.J. Wilkinson, 'Law, Part I, Introductory Sketch', *Papers on Malay Subjects* (Kuala Lumpur, 1908), pp.51-2. Rigby, op. cit., p.32.
5. *Fed. Leg. Co. Paper No.* 50 *of* 1948, p. C436.
6. *Report of the Rice Production Committee, 1953*, pp.116, 118.
7. *Draft Development Plan of the Federation of Malaya*, p.133.
8. *Proceedings of the Fed. Leg. Co., February, 1951 - February, 1952* (Kuala Lumpur, 1952), pp.77-8.

original size of each lot was seven acres. Between 1900 and 1954 approximately 13 per cent of these lots were subdivided and 7 per cent of these subdivisions were re-subdivided, so that the number of lots on the same area of land increased by 15 per cent and the size of each lot fell correspondingly to 6.25 acres. But each lot might have several co-owners who each possessed an undivided share in the land, that is, undivided in the sense that the partition had not been made by official survey and demarcated by boundaries, although in practice the co-owners had agreed on internal boundaries, and each of them treated his piece of land as his own in every other respect—leasing, transferring or otherwise disposing of it as he wished. Thus it would be the size of each share, rather than of each lot as appeared in the 'mukim' register, that would indicate the amount of subdivision that has taken place. The original average size of each individual share in 1900, when the titles were first taken out was 6.75 acres, and there were 106 co-owners for each 100 lots of land that were registered. By 1954, there were an average of 238 co-owners for every 100 lots, an increase of 159 per cent. The average size of each individual share was consequently reduced from 6.75 acres to 2.5 acres. A further indication of the degree of break-up of once undivided land into small parcels is given in Table 44.[1]

TABLE 44: COMPARISON OF PERCENTAGE DISTRIBUTION BY SIZE OF THE SAME PADI LAND, 1900 AND 1954

SIZE GROUP	PERCENTAGE OF SHARES, 1900	PERCENTAGE OF SHARES, 1954
LESS THAN 1 ACRE	—	24
1 TO 2 ACRES	2	29
2 — 3 ,,	7	15
3 — 4 ,,	14	10
4 — 5 ,,	23	13
5 — 6 ,,	9	2
6 — 7 ,,	4	3
7 — 8 ,,	11	—
8 — 9 ,,	9	—
9 — 10 ,,	9	1
10 — 15 ,,	7	3
MORE THAN 15 ,,	5	—
TOTAL	100	100

It will be observed that in 1900 only 2 per cent of the shares were less than two acres in size, while 54 per cent of them were over five acres. By 1954 the process of subdivision had advanced so far that 53 per cent of the shares were now below two acres each, and only 9 per cent of them were over five acres. Thus in 1954 over half of the padi-planters in Tanjong Piandang were cultivating plots of land of less than two acres each, an acreage which could not yield more than a poor subsistence level of living.[2] Some of them were cultivating several

1. T.B. Wilson, 'Some Economic Aspects of Padi-Land Ownership', *M.A.J.*, Vol. XXXVII, No. 3, 1954, pp.125-35.
2. It is considered that at least five acres of first class padi land are necessary to yield a reasonable standard of living to a peasant who has no alternative occupation; *Final Report of the Rice Committee*, p.8.

discontiguous plots which had been rented, or had been acquired through purchase or inheritance, thereby experiencing all the disadvantages of cultivating minutely-subdivided as well as fragmented agricultural land.

No survey has yet been made in Malaya of the degree of fragmentation in any agricultural area. Such a task is very difficult because the land registers do not show all the lots of each owner but only the owner of each lot. The complexities of tracing ownership in a field enquiry are such that it is difficult to establish the number and situation of the plots of land each planter cultivates. Wilson has calculated the annual rate of fragmentation of padi lands in Krian, basing his analysis on the changes of ownership between 1951 and 1954 as recorded in the land registers.[1] Most land transactions involve a change of ownership, and a transaction has a fragmentary effect if it increases the number of co-owners of each lot, and a consolidatory effect if it decreases the number of co-owners. In Krian, land was transferred in three ways: (1) the land might be voluntarily donated by the owner to members of his family during the course of his life; (2) it might be distributed according to either Malay customary law, or Muslim law, on his death; or (3) it might be transferred by outright sale. Forty-five per cent of the land transactions in Krian of the first type during the period 1951 to 1954 had a fragmentary effect; 54 per cent a neutral effect (that is, no changes in the size of the lots); and only 1 per cent had a consolidatory effect. The fragmentary effect was higher in the case of death distribution suits. Here 68 per cent of the transactions were of a fragmentary nature, 25 per cent neutral and 7 per cent consolidatory. Transactions of the third type were least fragmentary because sales were usually between two individuals, and so involved little change in the total number of owners. Thus 61 per cent of them were neutral in effect, 19 per cent fragmentary, and 20 per cent consolidatory.[2]

Wilson calculated that the total overall rate of fragmentation for all types of transactions came to 30 per cent per transaction, so that on the average every three transactions involved a near-doubling of the number of owners of a lot, and a corresponding halving of its size.[3] He also pointed out that, since the average time lapse between the date of death of a land owner and the date of the petition for a distribution suit was eight years and three months, the process of fragmentation was more advanced than might be realised from evidence in the local Land Office registrations.[4]

No true estimate of the position can be made until such time as accurate up-to-date data are available from the Land Offices. At the moment the backlog in land administration is sufficiently serious to warrant very special attention. The fact that 400,000 lots in Kelantan, 26,000 in Perlis, and 50,000 in Trengganu lack proper titles or current registration[5] is a good indication of the great gap between the situation as recorded in the land registers and the actual situation in the field, and subdivision and fragmentation in Malaya may have proceeded further than would appear from official records.

Social over-valuation of land arising from the prestige attached to land ownership, as well as economic considerations, lead to the retention of undersized

1. T.B. Wilson, 'The Inheritance and Fragmentation of Malay Padi Lands in Krian, Perak', *M.A.J.*, Vol. XXXVIII, No. 2, 1955, pp.71-7.
2. Ibid., Table X, p.88.
3. Ibid., Table XI, p.89.
4. Ibid., p.83.
5. *The Economic Development Malaya,* pp.308-9; also *Weekly News Summary* for the week ending 18th December, 1954, p.12; and the *Straits Times,* 5th November, 1955.

holdings. Attempts in Malaya to persuade heirs to reduce the rate of subdivision and fragmentation by voluntary transfer of shares have had limited success.[1] The International Bank Mission recommended that laws should be passed which would put a limit on the extent to which land could be subdivided, and that there should be a minimum size below which a plot of land could not be reduced. At present the only State where such legislation exists is Kelantan. Here the minimum area to which land could be reduced in size is 250 square depa, or one quarter of an acre, except in urban areas and in particular cases where the Sultan grants exemption.[2]

In 1955 the Federal Legislative Council passed a Bill designed to prevent excessive subdivision and fragmentation of land amongst the non-Muslim small estate owners.[3] The Collector of Land Revenue is given the power to exercise his discretion to prevent excessive subdivision, by ordering the sale of the land, or the transfer of part shares from one heir to another after due compensation has been paid.[4] No provision has yet been made to extend the law to the Malay peasants who follow laws of inheritance which are the most inimical to the preservation of unfragmented holdings.

But mere legislation is unlikely to be effective if it moves in advance of public opinion, and may lead to wholesale resistance and evasion. The establishment of a compulsory minimum farm size limits the number of farmers and the law becomes unworkable as population increases, unless there is alternative employment which can absorb the excess population. Such a restrictive measure, because it is aimed against the deep rooted desire to own land without removing the causes (social pride or prejudice), and without providing a suitable substitute or alternative to land ownership, must necessarily be only a partial solution, and a palliative rather than a cure.

From this survey of peasant land tenure in Malaya it is evident that the land problems that are characteristic of the more densely populated areas in Asia—subdivision, fragmentation, a landless peasantry, rackrenting, extreme insecurity of tenure, rural indebtedness, and related features—are incipient in the Peninsula, and to a certain extent already existing in the older established agricultural regions of the north-east and north-west.

The pressing need amongst Chinese smallholders, and the resettled population, is for longer-term land titles and greater security of tenure. Not only would this permit a better balance of agriculture with more attention paid to permanent instead of catch-crops, but it would also have a stabilising effect on the peasantry.

Among the Malay peasant land owners problems arise out of the conversion of land into a transferable and saleable commodity, and their inexperience in dealing with it. The lack of credit facilities, and extravagant expenditure for social reasons, have led to the mortgaging and loss of Malay land, the creation of a tenant class of smallholders and the abuses of excessive rents and insecure tenure.[5] These problems are not peculiar to Malaya but are found whenever

1. *The Economic Development of Malaya,* p.314.
2. Ibid., pp.314-15.
3. A 'small estate' is defined as 'an estate of a deceased person consisting wholly or partly of immovable property in the Malay States and not exceeding five thousand dollars in value'. *The Small Estates (Distribution) Ordinance, 1955* (Kuala Lumpur, 1955), p.2.
4. Ibid, pp.13-14.
5. T.B. Wilson, *The Economics of Padi Production in North Malaya, Part I,* (Kuala Lumpur, 1958).

economically unsophisticated peoples are suddenly given the right freely to dispose of their land. A second class of agricultural problems is of a technical and economic nature—subdivision and fragmentation. They have been accentuated by the social prestige attached to land ownership, and by the Muslim laws of inheritance which encourage the splitting up of property into parcels. As the population increases and greater pressure is exerted on available land it is to be expected that these problems would tend to become more acute and widespread with consequent effect on the peasants' standards of living.

CHAPTER IX

THE NUTRITIONAL STANDARD OF THE TROPICAL PEASANT

NUTRITIONAL DEFICIENCIES IN TROPICAL DIETS.

THE QUANTITATIVE and qualitative adequacy, or otherwise, of the food normally consumed by a peasant gives a measurable indication of his material level of living. In the tropical rural areas the greater part of the food supply is obtained locally. This is particularly true of those regions where the economy is a subsistence one. In areas where revenue crops are important, the peasant has to depend partly on imported food. The diet in the case of a subsistence economy is largely determined by local conditions of climate and soil, which condition the types of crops that can be grown and the animal foods that can be found. But cultural factors, too, play an important part. Dietary habits are greatly influenced by local religious customs and traditions relating to fasts, feasts, and taboos.

It is not certain what the minimum requirements for satisfactory nutrition in the tropics are, though it is possible to say that some diets are obviously inadequate and others more nearly adequate. While nutrition experts are agreed that the human organism needs to be supplied daily with a certain quantity of food energy; that the diet must yield protein, fat and carbohydrate; and that certain other food factors—vitamins and mineral salts—are also essential to growth, health and life itself; they are not fully agreed as to the proportions which should go into the optimum diet. For practical purposes, however, sufficient is known to enable standards of adequate food intake to be established. After wide experience in the tropical colonial areas, Platt has recommended that the daily diet should include the nutrients shown in Table 45. Diets which contain all the elements listed and in the amounts suggested are considered satisfactory from the nutritional point of view. Those who habitually consume diets with one or more of the specified items deficient, or missing, are considered under-nourished, and are liable to various deficiency diseases arising from a state of malnutrition.[1]

TABLE 45: ESSENTIAL ELEMENTS OF A TROPICAL DIET

ITEM	CALORIES	PROTEIN GM	CALCIUM MG	IRON MG	VITAMIN A I. U.	VITAMIN B1 MG	RIBOFLAVIN MG	NICOTINIC ACID MG	VITAMIN C MG
AMOUNT	2,500	60	800	20	5,000	1·5	1·8	12	30

The main problem which the tropical population has to face is not the total lack of food, which is associated with starvation and famine, but rather the lack of balance in its content which has a deleterious effect on their state of health. However, in many parts of the tropics, such as the tropical fringes where marked seasonality prevails and agriculture is based on cereals and annuals rather than on the perennial bananas and tubers of the equatorial regions, a periodical 'hunger season' often occurs towards the end of the agricultural year, when the last harvest is exhausted and the new crops have not yet been brought in. In parts of Northern

1. B.S. Platt, 'The Colonial Nutrition Problem', *Proceedings of the Nutrition Society*, Vol. V, No. 1-2, 1946, Table 4, p.7.

Rhodesia, for example, the hunger period may last up to three months in each year, during which time the peasants have to subsist on wild produce.[1] In Nigeria the period of semi-starvation which coincides with the dry season may last for six months at a time, when fresh foods may be unobtainable.[2] In Nyasaland the 'December-February food shortage at the Lower River occurs as regularly as ever—in good harvest years as well as bad, in dry years and wet years and flood years. In some years the hunger period commences earlier and lasts longer, and in some it is alleviated by late *dimba* crops of maize and sweet potatoes.'[3] The infertility of the soil, the debilitating effects of disease and the lack of satisfactory water supplies in some parts of the Northern Territories of the Gold Coast result in an inability to farm efficiently, and in poor harvests, so that there is a scarcity of food during the dry season. 'This follows season after season until the inhabitants are in a miserably under-nourished condition.'[4] In Tanganyika it is '... generally agreed that the majority of the population does not get enough meat and milk, and that there is an annual period of food shortage between harvests. This periodic shortage of food, involving a recurrent annual drain on native resources, is a question even more serious than the occasional outbreaks of famine.'[5] Throughout tropical Africa the hunger season occurs towards the end of the agricultural year, at a time when extra physical effort is needed to prepare the ground for the new crops. The discrepancy between the energy needs of the peasant at that time and his food intake has been estimated by Platt as up to 60 per cent of his requirements.[6]

In those areas of the South-east Asian tropics, including the Malay Peninsula, where padi has superseded other food-crops as the main staple, and the harvest cycle has become an annual one, hunger seasons are common. The 'patjeklik' or period of scarcity just before the new harvest occurs in many parts of Java. In Timor the population has a 'lapar biasa' (hunger season) each year during the dry season.[7] In parts of Malaya a shortage of rice may occur towards the close of the agricultural year, but this does not take on the dimensions, or the regularity, of the hunger period elsewhere. Sporadic instances of food shortages due to crop failures, however, do take place.

More than being deficient in amount, tropical diets lack quality. The Committee on Nutrition in the Colonial Empire, after an examination of forty-eight different territories mainly within the tropics, found great diversity in local diets. It also found several striking common characteristics. With few exceptions, the dietaries in colonial areas were predominantly vegetable in composition. An unusually high proportion of the energy value of the diets was derived from carbohydrates, and the amount of fat consumed was low. Little milk was taken, and fish was often the only animal food included. The diets were therefore low in animal proteins, and there was a general deficiency of fat, calcium, phosphorus, iron, sodium and various vitamins. 'Few of the constituents considered necessary in Europe for a nutritionally adequate diet are generally available in

1. J.M. Davis (ed.), *Modern Industry and the African* (London, 1933), p.41; also A.I. Richards, op. cit., pp.35-7.
2. *Summary of Information Regarding Nutrition in the Colonial Empire* (H.M.S.O., 1939), Cmd. 6051, p.39.
3. Nyasaland Protectorate, *Annual Report of the Department of Agriculture, 1937* (Zomba, 1938), p.44.
4. Gold Coast Colony, *Report on the Medical Department for the Year 1936* (Accra, 1937), p.4.
5. *Nutrition in the Colonial Empire* (H.M.S.O., 1939), Cmd. 6050, p.16.
6. Quoted in A.L. Banks (ed.), *The Development of Tropical and Sub-Tropical Countries*, p.101.
7. De Haan, 'Progress in Shifting Cultivation in Indonesia', pp.314-15.

sufficient quantities in the Colonial Empire. Diets are frequently insufficient in quantity and still more frequently insufficient in quality.'[1] After a comprehensive study of nutritional deficiency diseases in colonial territories, of infant and maternal mortality, of local diets and food consumption, and after experiments on the effect of dietary supplements on the clinical condition of under-nourished colonial peoples between 1936 and 1945, Platt confirmed the conclusions of the Nutrition Committee.[2] The recently compiled world maps of human starvation show most of the tropics as areas where the diets are lacking in energy values or protective values, or both. The only exceptions are: in the tropical Far East, Thailand and Formosa; in tropical Africa, a narrow coastal strip from the Equator northwards to the tip of the Somaliland peninsula; and in tropical America, a narrow riverine strip along the Colombia River.[3]

Living in an environment which does not encourage livestock rearing, the peasant has to depend mainly on vegetable sources for the bulk of his food.[4] Because of the larger amounts of land and labour required for its production, meat is an expensive food as compared with cereals, and this again tends to make it a scarce item in tropical diets. Gourou states that, in the tropics as a whole, animal foods do not make up more than 4 or 5 per cent of the total amount of calories.[5] The situation in the African tropics may be taken as an illustration. The basis of an African diet is a rough porridge made from maize or millets, with local variations such as cassava in the Angola highlands, plantains in Uganda, and yams in parts of the West Coast.[6] Fish is consumed wherever obtainable (by tribes living near lakes, rivers and the sea), but meat is eaten only occasionally, except by the pastoral tribes. Such a diet is lacking in protein, fat, vitamins and minerals, and gives rise to deficiency diseases such as scurvy, pellagra, oedema, xeropthalmia, night-blindness and skin infections.[7] Tsetse flies, enzootic diseases and lack of pastures limit the supply of meat. Over large areas the use of livestock as currency and for social rather than dietary purposes also prevents a more general consumption of animal products. Medical investigations reveal that the pastoral tribes consuming meat, milk and blood, instead of cereals, are better nourished. The Masai of Kenya, for example, whose animal protein consumption is from 200 to 300 grammes a day, are greatly superior in weight, stature and physical fitness to the neighbouring vegetarian Kikuyu, who suffer from bone deformities, dental troubles, anaemia, pulmonary conditions and tropical ulcers.[8]

An investigation into the history of African patients admitted to a hospital in Uganda shows that although their diet of sweet potatoes, cassava and plantain has a reasonable calorific value, it contains only 2 per cent, or less, of protein, and almost no animal protein. The most common malnutrition complaints are caused not from insufficient calories but from a deficiency of dietary protein. Neither milk, butter, eggs nor cheese are consumed. Groundnuts and beans are

1. *Nutrition in the Colonial Empire,* p.154.
2. B.S. Platt, 'The Nutritional Status of the Indigenous Peoples of the Colonies', *The Royal Society Empire Scientific Conference Report, Vol. I,* (London, 1948), pp.587-607.
3. J.M. May, 'The Mapping of Human Starvation, Diets and Diseases', *Geographical Review,* Vol. XLIII, No. 3, 1953, pp.403-4.
4. W.J.A. Payne, 'The Problem of Milk Production in Tropical Countries', *Tropical Agriculture,* Vol. XXXIV, No. 2, 1957, pp.137-43.
5. Gourou, op.cit., p.65.
6. Hailey, op. cit., p.888.
7. *Summary of Information Regarding Nutrition in the Colonial Empire,* pp.13-19; see also Hailey, op.cit., pp.1122-3.
8. J.B. Orr and J.L. Gilks, *The Physique and Health of Two African Tribes* (London, 1931), pp.62-4.

eaten once weekly, and meat or fish not more than once a month. This diet is extremely common among the African population.[1] A similar examination of the diets of three tribes in the Niger Province of Nigeria (Bida, Zuru, and Kontagora districts) shows that the main staples are Guinea-corn and bulrush millet, with cassava and sweet potatoes used to some extent in Bida. Small amounts of cow peas and green leaves are also eaten, but the only fruit available is the mango. Animal protein is scarce and available mainly as dried fish. Between 73 and 80 per cent of the total calories of the diet is derived from carbohydrates. The amount of fat (7 to 15 per cent of the total calories) consumed is lower than that normally considered adequate. The amount of riboflavin is low everywhere, as is calcium and Vitamin A. The overall conclusion is that dietary deficiencies produce physical incapacity of one sort or another in roughly half the population examined.[2]

The position in the Asian tropics is not markedly different, except that here rice takes the place of the African maize and millets. Consumption of the protective elements, especially animal protein, is low. According to Wickizer and Bennett, cereals in Monsoon Asia form 80 to 90 per cent of all food calories. This heavy dependence on cereals is due to the poverty of the population. Animal products supply only 1 to 10 per cent of the total food calories, as compared with the 30 to 40 per cent in western countries.[3]

While richer in food value than the other cereals, rice cannot by itself provide all the nutrients necessary for a satisfactory diet. A predominantly rice diet is lacking in the B group vitamins, as well as in vitamin A and calcium. These deficiencies are even more serious when the rice is highly polished. It has been calculated that the losses due to polishing amount to 29 per cent of the protein, 79 per cent of the fat, 84 per cent of the lime and 67 per cent of the iron content.

The move by many Asian governments to popularise the use of unpolished rice has met with two obstacles. Firstly, rice under-milled to the degree required to supply the necessary thiamine content will not keep as well as highly-polished rice under the poor storage conditions found in the rice-eating countries. Secondly, under-milled rice is less acceptable to the people's taste than polished rice. Platt has reached the conclusion that the disease beri-beri is less likely to occur when polished rice is the staple provided that (1) the rice is stored so that the Vitamin B1 is not lost; (2) it is not washed before cooking; (3) there is no superfluous water at completion of cooking; and (4) not less than 150 International Units of Vitamin B1 (as contained in six ounces of dried beans or three ounces of groundnuts) are included in the diet.[4] These measures may serve to prevent specific deficiency diseases, but the problem of more positive improvements in rice diets remains. This problem can only be solved by the addition of those nutrients which are lacking in a predominantly cereal diet, namely, animal protein, fat and

1. M.W. Starrier and E.G. Holmes, 'Malnutrition in African Adults', *The British Journal of Nutrition,* Vol. VIII, 1954, p.173; and E.G. Holmes, E.R. Jones and M.W. Starrier, 'Malnutrition in African Adults', ibid., pp.173-93.
2. B.M. Nicol, 'Nutrition of Nigerian Peasant Farmers, with Special Reference to the Effects of Vitamin A and Riboflavin Deficiency', *The British Journal of Nutrition,* Vol. III, 1949, pp.29-30, 36; also Nicol, 'The Nutrition of Nigerian Peasants, with Special Reference to the Effects of Deficiencies of the Vitamin B complex, Vitamin A and Animal Protein', *The British Journal of Nutrition,* Vol. VI, 1952, pp.34-55.
3. V.D. Wickizer and M.K. Bennett, *The Rice Economy of Monsoon Asia* (Stamford, 1941), pp.104-5, and map facing p.114; see also H. Belshaw, *Agricultural Reconstruction in the Far East* (New York, 1947), pp.11-12.
4. *Summary of Information Regarding Nutrition in the Colonial Empire,* p.198.

many of the 'protective' elements such as the B group of vitamins, vitamin A, calcium, iodine and lime.[1]

MALNUTRITION AMONGST MALAYAN PEASANTS.

The dietary position of the Malayan rural population is much the same as that of peasants in the other Asian rice-eating countries. The bulk of a Malayan meal is rice, with some fish and an appetiser made up of hot peppers, 'blachan' (salted fermented fish and shrimp paste), and other spices.

The Malay peasant traditionally husks and mills his own padi. The unpolished grain thus prepared retains most of its nutritive qualities. Unlike the urban Chinese, who prefer highly polished rice, the incidence of beri-beri amongst Malay peasants is low. The parboiled rice consumed by Indian labourers is equal in nutritive value to under-milled rice and serves to protect them against the disease.[2] However, with the rapid growth of population, the heavy importation of polished rice, and the establishment of rice mills in all the main padi areas, there has been a growing tendency for the peasant to turn to polished rice. In 1939 an analysis of samples of kampong rice, as ordinarily eaten by the Malays, collected from all districts throughout the Peninsula showed that 34 per cent of them were definitely over-milled, 51 per cent medium-milled and only 15 per cent under-milled.[3] Since the amount of loss of nutritive value in rice corresponds roughly to the degree of milling and polishing it has received, it is evident that about one-third of the Malay peasants in Malaya were exposed to the dangers of rice-deficiency diseases.

Malayan peasant diets are also deficient in the animal protein foods. This is partly because the poverty of the peasant prevents him from buying meat, milk and eggs. Social customs and taboos are also partly responsible. For instance, the Malay, living in an equatorial environment where cattle do not fit in, has no tradition of milk-drinking, and rarely consumes milk or milk products. Chinese peasants consume little milk, but all except the very poorest find an alternative source of animal protein in pork. Religious taboos prevent the Malays from eating pork, and the most common form of protein taken by Malays is dried or salted fish. One of the pronouncements made by the former King Edward VII College of Medicine, after ten years of research on nutritional problems in Malaya, was that a diet of polished rice and dried fish was devoid of vitamins and minerals, and it 'might well be considered a poison rather than a diet'.[4]

The nutritional surveys that have been conducted among Malayan peasant groups, from time to time, have all unanimously concluded that a high percentage of the peasants, especially among the poorer classes, lived on a diet of marginal or sub-nutritional standard. Vickers and Strahan in their health survey of Kedah in 1936 found the Malay peasants living on a monotonous and insufficient diet, with no meat except on feast days. The main form of protein was derived from fish. There was considerable apathy to the cultivation of good class vegetables and leguminous crops. Poultry and goats could not be kept because of wild animal depredations. The diet was deficient in energy value, in high class protein, and in Vitamin B1. Peasants living in the more remote inland areas were worst off. 'The fact appears to be that the rural Malay lives on the "verge of safety" and

1. Grist, *Rice*, pp.243-4, 247.
2. C.E. Cobb, 'Beri-beri and Rice Control in Malaya', *I.M.R.*, Bulletin No. 4 of 1924, pp.1-3.
3. I.A. Simpson, 'The Anti-neuritic Value of Parboiled Rice, A Comparison with Under-milled Raw Rice', *I.M.R.*, Bulletin No. 4 of 1939, p.1. footnote.
4. Mills, op. cit., p.310.

that any crisis or abnormal endeavour to his usual life of short periods of work and long periods of ease tends to produce some form of mild deficiency disease.'[1] An official of the Health Department estimated that some 90 per cent of the rural families living in Province Wellesley were undernourished.[2]

In its official report to the Committee on Nutrition in the Colonial Empire, the Malayan Committee stated that the diets of most of the Malayan population were deficient in proteins, B group vitamins and fat. Gross deficiency diseases were reported to be common. Malay diets in general were found to be lacking in energy value, first class protein and B vitamins. Forty per cent of the children in coastal and rubber areas, and 60 per cent in the more remote areas, were below par and in need of extra nourishment. The diets of Indian labourers in estates, though slightly better than those of the Malays, were also ill-balanced and lacking in proteins and fats. The main obstacles to improvement were the general poverty of the people and their preference for polished rice. Because of the lack of surveys on dietary conditions in the rural areas, the Committee could not advocate any certain measures to correct the state of sub-nutrition.[3]

In 1947 the Institute for Medical Research conducted a detailed enquiry into the standards of living of Malay peasants in coastal Malacca. It chose specially those areas where living conditions were fairly typical of other peasant areas in Malaya. A table of per capita requirements for adequate nutrition was prepared according to the recommended dietary allowances of the United States of America National Research Council. The dietary position of the peasants is summarised in Table 46. As the table indicates, the diet of the peasant was not only inadequate quantitatively, but was also deficient in all the protective elements except iron and Vitamin C. 'Even judged by the lowest standard for an adequate intake, these diets are deficient and the clinical and statistical information on morbidity and mortality supports the dietary findings.'[4] It was also discovered that there was a definite relationship between the income level, expenditure on food, and the calorie and protein intake. Those with the lowest income spent a total of $7 to $8 per male adult per month on food which was 50 to 60 per cent deficient in calories and proteins. The quantity and quality of the food did not approach the minimum nutritional levels, except in the case of those whose food expenditure was at least $15 per male adult per month. The fact that some 60 per cent of the households surveyed spent less than this sum per month is a good indication of the prevalence of sub-nutritional diets among peasants.[5]

TABLE 46: THE AVERAGE PER CAPITA DIETARY INTAKE OF SAMPLE PEASANT GROUPS IN MALACCA, 1947

DIETARY INTAKE	CALORIES	PROTEIN GM	CALCIUM GM	IRON MG	VITAMIN A I. U.	VITAMIN B1 MG	RIBOFLAVIN MG	NIACIN MG	VITAMIN C MG
RECOMMENDED ALLOWANCE	2,100	60	0·9	10	4,000	1·1	1·5	10	30
ACTUAL AVERAGE INTAKE OF PEASANT GROUPS	1,630	47	0·6	12	2,400	0·9	0·5	8·6	40

Source: *Malayan Union, Annual Report of the Medical Department, 1947*, pp. 8.9.

1. *Vickers and Strahan*, op. cit., pp.2, 60, 87-90.
2. *Proceedings of the Legislative Council, Straits Settlements, 1937* (Singapore, 1938), p.B148.
3. *Summary of Information Regarding Nutrition in the Colonial Empire*, pp.58-63.
4. *Malayan Union, Annual Report of the Medical Department, 1947*, p.9; also *Proceedings of the Fed. Leg. Co., February 1948 - February 1949*, p.B458.
5. Ibid.

Further dietary and clinical investigations were conducted by officers of the Institute for Medical Research in 1949 among two peasant groups living on the coastal plain of Malacca, and another group of wage-earning Indian labourers working in a rubber estate twelve miles inland. The three representative groups of peasant agricultural smallholders, peasant fishermen and wage-earning labourers, each consisted of thirty-seven to fifty households with between 130 to 260 persons. Detailed examination of the diet of each household was carried out for one week and the results checked and compared with a less detailed record kept over one month. The dietary values of the food consumed by each, as compared with the values recommended for adequate nutrition under Malayan conditions, are shown in Table 47. The contrast in the positions of the peasant and estate labour groups is evident. While the estate labourers' main dietary deficiencies were in Vitamins A and B1 and Riboflavin, both the agriculturists and fishermen suffered from shortages in all the protective elements except iron and Vitamin C, and also from plain hunger due to lack of calories in the diet. The fishermen had smaller and less regular incomes than the smallholders and therefore spent less on food. They often suffered acutely from hunger.[1] But both smallholders and fishermen were badly off compared with the labourers, and were thin, hungry, lacking in initiative and inclined to work less.[2] All the groups examined showed clinical evidence of malnutrition, such as diseases of the skin, eyes, lips, tongue, teeth, gums and face. There was little external evidence of protein deficiency among the adults. Among the children, however, there were some indications of malnutrition due to the inadequate protein intake. This may be due, in part, to the Malay belief that fish (the main source of animal protein) was bad for the weaned infant. A correlation was also discovered between the occurrence of beri-beri and the consumption of highly milled rice by the Malays.[3]

TABLE 47: THE ESTIMATED VALUE OF FOOD CONSUMED PER PERSON PER DAY AMONG LABOUR AND PEASANT GROUPS IN MALACCA, 1949

DIETARY INTAKE	CALORIES	PROTEIN GM	CALCIUM GM	IRON MG	VITAMIN A I. U.	VITAMIN B1 MG	RIBOFLAVIN MG	NIACIN MG	VITAMIN C MG
RECOMMENDED ALLOWANCE	2,100	60	0·9	10	4,000	1·1	1·5	10	30
PEASANT AGRICULTURISTS	1,630	47	0·5	12	1,084	0·6	0·4	8·6	29
PEASANT FISHERMEN	1,560	43	0·6	12	1,630	0·5	0·4	9·0	39
LABOURERS	2,240	60	0·9	17	1,838	0·75	0·7	11·0	50

Source: Burgess and Alang Musa, op. cit., Table XII, p. 32.

The rise in the incidence of beri-beri among peasants in Malaya was due to external circumstances. In the period immediately after the war rice was rationed and the peasant population had to supplement their rice with other cereals. The mixed diet provided sufficient Vitamin B1 to prevent beri-beri from occurring. With the gradual restoration of normal conditions, rice stocks began to increase and highly polished rice was sold freely. The peasant returned to a full rice diet. Since the shopkeeper preferred to stock the highly milled variety, there was a general increase in its consumption, and a corresponding deterioration in the nutritional condition of the population who could not afford a variety of other

1. Burgess and Alang Musa, op. cit., pp.33-4.
2. *Federation of Malaya, Annual Report of the I.M.R., 1949,* pp.6-7.
3. Burgess and Alang Musa, op. cit., Table IV, p.11; and pp.12-23, 35.

foodstuffs to supplement their diet. Burgess and Alang Musa found evidence to show that the Malays who purchased highly milled rice were slowly returning to their pre-war condition, characterised by a high incidence of beri-beri.[1]

The poor quality and ill-balanced nature of Malay diets was made unnecessarily worse by food taboos and prejudices. Young children were deprived of their major source of protein because of the belief that fish was bad for them. The handicap of indifferent health, resulting from a purely carbohydrate diet early in life, could probably never be really surmounted in later life. Another custom was to feed newly delivered women for forty-four days on rice and dried fish, with grave consequences to both mother and child. Some of the wild leaf vegetables which were eaten extensively in other parts of the Peninsula were not included in the Malacca Malay diet at all, nor were legumes eaten, though they were cheap and easily obtainable.[2] There was a deep prejudice against maize and root vegetables, because it was thought that they were responsible for the many diseases that occurred during the Japanese occupation, when these articles of diet were regularly substituted for rice.[3]

The main cause of the sub-optimal health and poor diet of the peasant groups examined was their economic poverty. The investigation also included an estimate of the total family incomes of each of the population groups. In the income estimates not only the cash income but also all articles produced by the individual, either in the form of food for home consumption or in the form of anything required for household or other use, were valued and recorded. The results confirmed the fact that the labourers were better off than the peasants. Sixty per cent of the smallholder and 62 per cent of the fisherman families had incomes of less than $80 a month. By comparison, only 38 per cent of the labourer families were in this income class.[4] All those with incomes of less than $100 per month spent 80 to 95 per cent of it on food.[5]

There were thirty-three Malay families of three to ten persons in each of the below $60-a-month class as compared with two Indian families of three to four persons each.[6] The Malay peasants were therefore not only earning less than the Indian labourers, but they had to spend their earnings on feeding a larger number of people. They were forced to buy the cheapest foods available. It was calculated that the Malay diet cost twenty cents per 1,000 calories as compared with the thirty-one cents of the Indian diet. The general picture, therefore, is one of poor health in the Malay rural communities due, to a great extent, to an inadequate diet resulting from poverty.

MALNUTRITION, DISEASE AND WORK IN TROPICAL AREAS

Diets which are inadequate both in quantity and quality may directly cause certain deficiency diseases, and indirectly lead to a susceptibility to infection due to lowered resistance from undernourishment. There is a relationship between disease susceptibility and undernourishment, though the former is also influenced by the prevalence of disease vectors, the absence of public health organisations,

1. Ibid., pp.36-9.
2. *Federation of Malaya, Annual Report of the I.M.R., 1949,* p.44.
3. Burgess and Alang Musa, op. cit., p.42.
4. Ibid., Table XXI, p.51.
5. *Federation of Malaya, Annual Report of the I.M.R., 1949,* p.45.
6. Burgess and Alang Musa, op. cit., p.52.

hospitals and hygiene consciousness amongst the rural population.[1] Faulty and inadequate diets cause such deficiency diseases as rickets, beri-beri, pellagra, dental caries, certain types of anaemia and tropical ulcers. Cereal-based diets are poor in calcium and contribute to the prevalence of tropical ulcers. A medical examination of a cereal-eating African tribe showed a high incidence of tropical ulcers (they accounted for 35 per cent of the total morbidity), while a similar examination of a pastoral tribe subsisting on a calcium-rich diet of meat, milk and blood showed a contrastingly low incidence of the disease (3 per cent of the total morbidity).[2] The deficiency diseases prevalent in the colonial areas were discovered to have been due to the lack of Vitamin A, while in the rice-eating countries the extent of beri-beri due to Vitamin B1 deficiency was found to be more widespread than suspected. Pellagra was also common.[3] There is now a '... general concensus of belief that there exist with great frequency, especially in the tropics, deficiency states which while not resulting in manifest disease... are more insidious than the clearly defined deficiency diseases and are a much more important factor in the lives of the people.'[4] The same opinion has been expressed by Gillman, who states that while chronic malnutrition in Africa is less obvious and may not manifest itself in nutritional breakdowns early in life, it soon leads to chronic and incurable liver diseases and premature heart failure. The mental sluggishness ascribed to the African might well be the indirect result of nutritional troubles causing cerebral damage.[5]

There is also a close relationship between diet, physical development and efficiency. This is a factor of great importance amongst the predominantly agricultural population of the tropics, whose standards of living depend largely on the amount of physical work they can perform. It has often been observed that a person who has to perform hard manual work on a defective diet has a tendency to develop deficiency diseases. In Malaya, the Malay peasants who lived on a poorer diet than the Indian labourers were also much less active. The Institute for Medical Research has recorded the average number of hours performed per day by Malay smallholders and fishermen as compared with that performed by Indian labourers. The male agricultural peasant worked an average of 3.3 hours per day, 2.5 hours of which were very heavy to heavy work and 0.5 hours light work. The fisherman did 5.1 hours a day, of which 4.6 hours were in work of a very heavy nature. The Indian labourer did 5.1 hours of very heavy to heavy work per day and 2.3 hours of light work, so that he totalled an average of 7.5 hours, in contrast to the 3.3 and 5.1 hours of the peasants.[6] The lack of energy was partly caused by a marginal diet, and the combined effects of a defective diet and a hot and humid climate were such that very heavy physical effort over long periods was difficult.[7]

The relationship between indolence and defective diets has also been noted in other parts of the tropics. In the West Indies, for instance, an agricultural labourer has been estimated to work an average of 5.0 hours a day for four days

1. J.W. Howie, 'Nutrition and Susceptibility to Infection', *The British Journal of Nutrition*, Vol. 11, 1948-49, pp.331-7.
2. M. Hughes, 'Tropical Ulcer', *The Malayan Med. Jrn.*, Vol. VI, No. 4, 1931, p.117.
3. *Nutrition in the Colonial Empire*, pp.154-5.
4. Ibid., p.155.
5. T. Gillman, 'Chronic Malnutrition in Africa', *The Listener*, 3rd May, 1956, pp.539.
6. *Federation of Malaya, Annual Report of the I.M.R., 1949*, p.46.
7. Ibid., pp.43-4; and Campbell, 'Diet, Nutrition and Excretion of the Asiatic Races in Singapore', p.110; see also *Report of the Malayan Delegation to the Inter-Governmental Conference of Far Eastern Countries on Rural Hygiene*, pp.26-7.

in a week.[1] In tropical Africa subsistence cultivators found it comparatively easy to obtain the food needed to sustain them at a low level of nutrition by working for only sixty days in a year. But the inadequacy of the diet quickly became apparent, for it caused the deaths of many Africans who were called upon to do heavy and unaccustomed work in the early days of African development.[2]

Malnutrition produces listless, apathetic and ineffective workers, and is one of the greatest handicaps to labour efficiency. Against this basic defect, artificial stimulus such as the wage incentive has been found to be ineffectual.[3]

It has been shown that the nutritional standard of the tropical peasant is very low. The food that he consumes is deficient in quantity but more often in quality. The low level of his diet also indicates his low material standards of living, for food is a basic and measurable component of the association of factors that together make up an individual's standard of living. A rise in the peasant's living levels should mean above all an improvement in the quantity and quality of his food. The goal to be aimed at, therefore, should be the elimination of a monotonous, predominantly carbohydrate diet. The ideal diet for Africans should consist of a variety of natural foods—eggs, bread, butter, milk, fish, vegetables and the like—in quantities sufficient to reduce the maize (or other staple) proportion.[4] This could well be taken as an ideal for Malayan peasants whose present diet is not much different from that of the Africans except that rice is the staple instead of maize or millets.

But between the ideal and the practical achievement of the ideal is a vast gap which can be bridged only slowly, for, in so far as the quantity and quality of the normal food consumed depend on the standard of living, so also an improvement in the former cannot be realized without a rise in the latter. Numerous problems and obstacles of a physical, economic and social character must be solved or surmounted before the standards of living of the rural population in the tropics could be raised. This is bound to be a long and difficult task. At the moment, according to the Colonial Nutrition Committee,[5] the low standard of living is the fundamental cause of malnutrition in tropical areas. The difficulty here is that the one tends to perpetuate the other, for while it is true that low living standards cause malnutrition, it would be just as true to say that a population which is undernourished, weak and suffering from deficiency and other diseases would find it extremely difficult, physically as well as mentally, to produce the extra effort necessary to break the vicious circle and climb onto a higher plane of material living. Yet unless this is done, schemes and plans for rural development would remain as blue-prints untranslated and untranslatable into concrete reality.

1. Seager, op. cit., p.44.
2. *The Colonial Problem,* p.142; also H.C. Trowell, 'Malnutrition and Work Output', *The Colonial Review,* Vol. VI, No. 1, 1949, pp.8-10.
3. C.H. Northcott, 'African Labour Efficiency,' *The Colonial Review,* Vol. VI, No. 3, 1949, pp.71-3; also C.H. Northcott (ed.), *African Labour Efficiency Survey* (London, 1949), pp.83-116.
4. Gillman, op. cit., p.549.
5. *Nutrition in the Colonial Empire,* p.156.

CHAPTER X

CONCLUSION

IN MOST tropical countries the rural population has a low material standard of living. This is a result of a unique combination of physical, economic, social and political processes which vary, not only from one country to another, but also from region to region within each country. Therefore in discussing specific problem areas, or when trying to elucidate the relative importance of any one process or factor, general concepts of wide applicability become of less significance than the careful analysis of unique situations.

Nevertheless, within the bounds of this qualification, and taking cognizance of the fact that the situation may change with changes in attitudes, objectives or technologies at a different period of economic history, several generalizations could be made about the problems of rural development in tropical areas.

The most striking feature of the economic situation in the world today is that most, if not all, of the countries in the tropics are materially underdeveloped as compared with countries in Western Europe and North America. Economists, and other social scientists, have tried to account for this in terms of human attitudes and institutions, but the explanations have been advanced *in vacuo,* as it were, for little attempt has been made to assess and relate the role of the tropical environment to this fact of differential development. Yet what Pelzer terms 'the chains formed by environmental factors'[1] cannot be ignored in any discussion or explanation of the reasons for the differences in living levels of the population groups in tropical and temperate lands. The environmental factors become of fundamental importance in those regions where man has advanced least in the modification or control of the physical and biological environment, and where he still has to depend largely on hunting and gathering, fishing and agriculture for his livelihood, as in the tropical countries.

During the course of this study, it has become clear that the environmental factors occupy a key place, though they cannot be used to excuse tropical underdevelopment. Peasants in tropical countries, in contrast to those in temperate latitudes, suffer from several serious disadvantages which bear on their physical as well as their economic state. In the first place, it has been shown that the tropical climate with its high temperature and humidity, and especially its monotony, is far removed from the ideal climate for physical activity. While the significance of this factor cannot be exactly determined, it nevertheless constitutes a hindrance to the efficient working of a population group engaged mainly in outdoor manual labour. Secondly, the tropical environment is highly favourable to the development of a large number of infectious diseases, as well as of the numerous vectors which help to transmit them. Tropical areas are the home of many infections unknown to, or of minor importance in, temperate regions. Again, the vectors which transmit disease in the temperate latitudes are dormant or inactive during the cold season. There is no such general intervening rest period in the tropics, so that the chances of infection here are correspondingly greater. Thirdly, tropical soils are, with few exceptions, easily eroded, unstable

1. Pelzer, 'Geography and the Tropics', p.316.

and infertile. A measure of this infertility is the poorer yields obtained in the tropics than in temperate latitudes from such crops as rice and maize.

Because of these inherent disadvantages, arising from the nature of the tropical environment, it would appear that proportionately greater efforts must be expended to lift the peasant out of the rut of mere subsistence to a higher material plane of living than would be necessary in the case of a similarly placed peasant in a temperate region. It is, however, obvious that it is impossible to determine the relative effort required because of the large number of imponderable human factors involved.

But the low standards of living of the tropical rural population are also the result of factors other than an unfavourable physical and biological environment. As has been shown, undernourishment and its consequences, rural indebtedness, poor market and transport facilities, price fluctuations, insecurity of land tenure and excessive subdivision and fragmentation of land, among others, are also directly or indirectly responsible. Coupled with these are the less tangible, but no less important, questions of the prevailing social and religious attitudes towards economic matters. Peasants who do not regard their economic status in life with any concern, and who place custom and religion above better food or housing or health, would understandingly find it difficult to change their attitude overnight, assuming even that they wanted to change them. This is more an educational and sociological than an economic problem, though it has undoubted economic implications.

What has emerged from this study, then, is that a multiplicity of obstacles and difficulties stand between the tropical rural population and higher living standards. A complexity of causes and part causes is involved. No one cause can be said to have overriding significance, but all of them contribute towards the final state. There is an interrelationship and mutual causality of all the factors which find outward expression in a vicious circle (for example, of low soil fertility leading to small yields, inadequate and deficient food supply, weak resistance to disease, diminished effort, and still lower yields), or a series of vicious circles, each one dependent upon and helping to promote the existence of the other.

It is apparent therefore that the solution to these problems must be worked out, and in fact can only be worked out, by taking note of this interrelationship. No plans envisaging the economic elevation of the tropical peasants can be effective unless a simultaneous multi-frontal attack is initiated. Such would be the ideal course of action, but it rarely happens that the ideal can be translated into reality, and so a second-best but workable line of operation, involving grading into priorities and combinations of priorities, is often substituted. Frequently, however, a series of isolated attempts are made towards the solution of a particular problem, without corresponding attempts being made to solve other but related problems which are in themselves part causes of the original problem. Thus for example, rural indebtedness in Malaya first attracted public and Governmental attention in the nineteen-thirties, when it was discovered that a large number of Malay peasants were heavily in debt and were having to sell their land in order to liquidate these debts. The Government's answer was to pass laws devised to prevent land from being a freely negotiable and transferable commodity, but this did little to the alleviation of the peasant's burden. Nothing positive was done to eliminate the root-causes of indebtedness—the lack of credit facilities, the tendency to spend more than could be afforded for social occasions, and the poor and imperfect conditions of marketing, distribution and transport. The upshot is that rural indebtedness continues to be a major economic evil in the country.

It is inevitable that progress in banishing rural poverty in the tropical countries would be a slow affair. At the same time there is a real chance that any gains may be more than offset by a disproportionate increase in population numbers. The rates of population growth in the underdeveloped areas of the world—in Latin America, Africa and Asia—are in the region of 2 per cent per annum.[1] The rate in Malaya exceeds 3 per cent per annum, and at such a rate the population will double itself in less than twenty-five years. Because of these high rates, it would be difficult to maintain the population at the existing standards of living, let alone at higher standards. For instance, at a recent meeting of the Consultative Committee of the Colombo Plan, it was stated that each material gain brought about by the implementation of the Plan had so far given no benefit to the individual because it had been overtaken each time by increases in the population numbers.[2] Under such circumstances, there can be no real improvements in living levels, unless the improvements are on a scale sufficient to offset the growth in the number of extra mouths which must be fed.

The political atmosphere of the world today makes it imperative that a solution be found for poverty and underdevelopment in the tropical countries. But there is still a lack of information on many of the vital aspects of the physical and human set-up in these areas. What is becoming clearer is that the difference in conditions between the highly industrialized western temperate countries and the tropical regions is such that the methods adopted to foster economic development in the former countries, when transferred to the tropical setting, often create more problems than they help to overcome. Unless an integrated and perhaps unique approach is made, and unless as much attention is paid to the facts of the physical environment in relation to the peasant economies as is paid to human institutions and attitudes, there will be little solid headway in the attempts to solve the problems of rural development in the tropics.

1. U.N., *Population Growth and the Standard of Living in Underdeveloped Countries*, p.3.
2. *The Times*, 17th October, 1955.

THE JOURNAL OF TROPICAL GEOGRAPHY

Formerly *THE MALAYAN JOURNAL OF TROPICAL GEOGRAPHY*

From two to four volumes of the Journal are published each year.

All correspondence concerning the Journal should be addressed to:
The Editor,
The Journal of Tropical Geography,
Department of Geography,
University of Malaya,
Singapore, 10.

CONTRIBUTIONS

Should be addressed to the Editor in double-spaced typescript, on one side of the paper only, and should not exceed 4,000 words. Authors should clearly state that their article is unpublished and not under consideration elsewhere. References in footnotes must include full details and be numbered consecutively. Illustrations, maps and photographs should be submitted in reproducible form with fully explanatory captions and a note to the Editor regarding the copyright. The Editor reserves the full right to adjust articles to conform with the Journal's format.

Editor

W. L. Dale, M.B.E., M.Sc.